SCIENTIFIC AMERICAN

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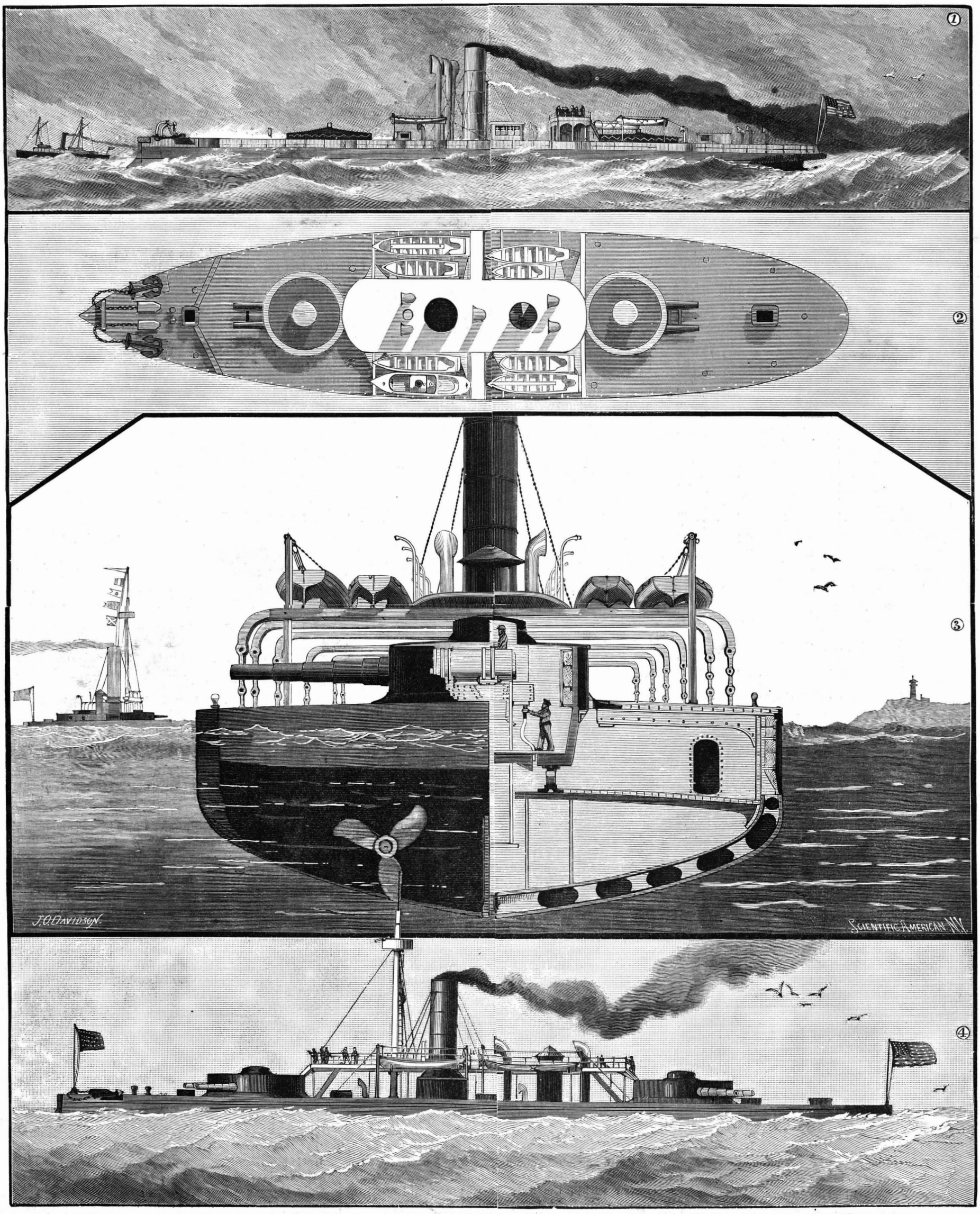

1. The Terror en route from Chester, Pa., to New York. 2. Deck plan and general view. 3. Sectional view, showing exterior and interior. 4. The Terror as she will be when cleared for action.

NEW UNITED STATES MONITOR TERROR, OF THE AMPHITRITE CLASS.—[See page 341.]

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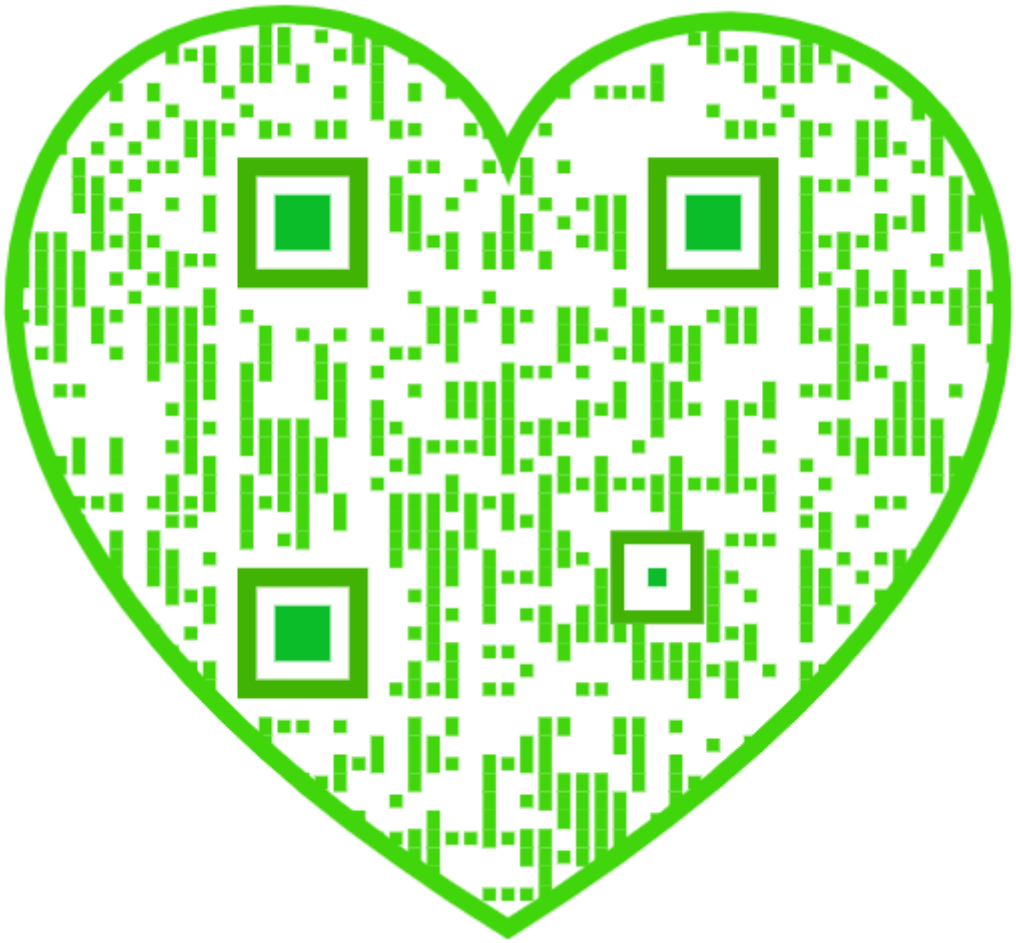

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TALL CHIMNEY ENGINEERING.

Some very striking examples of the resources of engineering have been furnished by the treatment of tall chimneys, in some cases the tragic side of the profession coming into relief. The problems presented for solution by these structures are difficult. It often happens that a chimney settles a little on one side, and becomes dangerously inclined from the perpendicular. In such a case it has to be straightened. Sometimes the operation is successful, but in a number of instances the chimney has fallen after the operation.

Probably the worst of these accidents on record happened in the case of Newland's mill chimney, Bradford, England, a shaft rising 260 feet from the top of the foundation. When it was nearly completed, it was found to be bulged on one side and hollow on the other. The settling occurred during a single night. To straighten it, two cuts were made extending about one-half around it, which, as fast as made, were filled with stone one-half inch less in thickness than the cut. Iron wedges were driven above the new stone to take the weight. The cuts were made little by little, so that no change occurred until the wedges were knocked out. The chimney then settled down on the side where the cuts were, and was straight. It was then completed. Nine years later some cracks appeared and were repaired. Again, after ten years more had elapsed, some pieces of the outer casing dropped off, and two days later the whole upper portion of the chimney fell, killing fifty-four persons and doing about $100,000 worth of damage. Just before the collapse stones and mortar were observed to burst out from the locality of the cuts.

In the neighborhood a successful operation of the same character was performed. A chimney at Bingley, near Bradford, was found to be four feet six inches out of perpendicular. A gap a foot high was cut clear through one side of it. Screw jacks were inserted in the cut as fast as the cut progressed, and as each was put in place it was screwed up hard against an iron top plate. A similar plate was placed under each jack. When about half the circumference of the chimney was cut through, the jacks were slowly turned down until the chimney was nearly straight. The gaps between the jacks were bricked up, the jacks were taken out one by one, and masonry was put in their place. When all were removed the shaft was perfect, the compression of the new work having completed the straightening.

In another instance a chimney 132 feet high settled until its top was 3 feet 2 inches out of the perpendicular. This was at the works of Matthews & Sons, in Gloucestershire. A course of bricks was taken out for five-eighths of the circumference and replaced by a course 1⅝ in. less in height. As fast as the cut was made the new course was laid and iron wedges were driven in above it. When all was in place, the wedges were driven out, and the chimney came back to within an inch or two of the perpendicular.

Chimneys will stand these operations if of good material originally; but if the brick and mortar are inferior, they will be apt to succumb. A shaft in Oldham was being straightened in the above manner. The owner protested, taking the ground that the mortar should alone have been sawed, and went off a little distance with one of the workmen to observe it, when suddenly the pile fell, burying one man in the bricks and destroying an adjacent building. The brick and mortar were both of inferior quality.

It is by no means the universal custom to treat the problem in so radical a manner as by the removal of a portion of the bricks or stones. Often the mortar between two of the courses of brick is sawed out on the higher side and the operation is repeated on the other joints until the work has been completed.

The moving of a chimney has been successfully accomplished. In Brunswick, Maine, a seventy-eight foot chimney was moved twenty feet on greased planks. It weighed about 100 tons. Inside of nine hours it was again at work in its new position, receiving the products of combustion from the fires.

The erection is generally conducted by the ordinary methods in use in regular building. Sometimes a radical departure is made. An iron chimney over 150 feet high has been built from the bottom upward. A section of the chimney twenty feet high was first built. This was raised vertically four feet, and a circle of plates four feet high was riveted to it at the bottom. The whole section, now twenty-four feet high, was lifted again four feet, and a new course was riveted on, and this was continued until the whole was complete. A hydraulic ram did the lifting. Of course this method could not well be applied to other than a sheet iron shaft.

In the demolition of a high chimney some ingenuity can be shown. A chimney in Middlesborough, England, was taken down brick by brick from the top downward. A long chute one-half an inch longer and wider than a brick in its cross sectional dimensions was first erected within the flue. It was air tight and rose from an air tight box placed at the bottom of the chimney. The bricks were dropped one by one through this chute, and were cushioned by the air so that none were broken or injured. From time to time the box was opened and the bricks that had accumulated were removed.

THEATRICAL EMOTION.

Who, sitting at the play, has not wondered if those portraying passion were not moved at their counterfeit presentment—so real it seemed. There's the man in a passion, actually red in the face and trembling visibly; the mother weeping over her child. How true it seems! If she be not crying, there is every evidence about her of profound grief. See how she throws up her arms as though appealing to the heavens for aid; watch the muscles of the face, the expression of her eyes, and note the depth of feeling in that sigh she fetches. Is all this but simulation? So it has often been alleged; only theatric trickery. Now, however, comes a medical authority who insists that no one can simulate passion truly without feeling it—at least to a certain extent. He says that the players themselves will sustain his assertion—the best proof of all being that, from the earliest days of their apprenticeship, they were bidden to imagine themselves the personages they would counterfeit.

Any one who has ever been before the footlights when a company was being drilled will remember the frequent recurrence of such remarks as these by the stage manager: "Mr. Jones, you're not feeling the part, you're only acting it. No man ever looked as you do when he was really mad. Miss Smith, you would not cry in such a happy-go-lucky fashion, were you really cast adrift on a deserted island. Try and imagine such a condition; think of your forlorn state, the fact that you are not likely to see home and friends again. Perhaps you will starve, or be eaten by wild beasts when night comes"—and so on.

Another authority, in a recent paper on the subject, takes the opposite view, insisting it is all mechanical. He says: "By long practice we are enabled to intervene between the psychological and the muscular or vascular conditions. Our social education accustoms us, from infancy upward, to the exercise of some sort of control over the exhibition of the emotions, and to the well-trained individual it is comparatively easy to prevent his face divulging his thoughts and feelings. In the same way actors gradually become enabled to tear a passion to tatters without showing the emotion to which their mimicry gives rise in the onlookers. An actor who really wept or really laughed would be as little fitted for his task as a medical man who really experienced the sympathy which his speech and manners are intended to convey. Not that there is anything hypocritical in either case, but both have acquired the ability to disassociate the feeling from its normal manifestations. From a theatrical point of view, it is surprising what education and practice can do toward converting into voluntary acts phenomena which, in other people, are utterly beyond the sphere of the will."

NEW ANIMALS AND BIRDS IN THE CENTRAL PARK.

The leather turtle, newly come to the Central Park collection from southern Texas, is so rare that none has been shown here before, and so curious as to well repay a visit to the pigeon house, where, in the little pool, he lies for hours blinking lazily; the birds coming down to its edge to drink keeping one eye on the dull, sodden-looking creature, with vampire-like beak and telescopic neck. A keeper brought him into Superintendent Conklin's room one afternoon last week, and as he made off for a dark corner, his back—he is about eighteen inches long—moved in rhythmic waves with every movement. Instead of shell and bone, like other turtles, it is elastic and ductile. Indeed, you can almost double him up, even the frame seeming more like cartilage than bone. He is said to be as toothsome as green turtle, is found in fresh water, and was given to the Park by Mr. J. W. De Peyster.

There are now a pair of wild Barbary sheep (*Obis trangelaphus*) in the inclosure near the Arsenal. They are very young, but when full grown will be quite as large as Rocky Mountain sheep, standing about four feet high. The wool is fawn-colored and short. The ram has a great mane, and his fore legs well feathered. The horns are long, heavy, and curving.

A South American deer of the red variety was recently given the Park by Dr. Spitska.

There is a cow blackbird in the bird house, brought to this port by a ship of the Hamburg line of steamers. When the ship was fully 800 miles off the coast, this bird flew aboard during a November storm. It seemed utterly fagged out, alighted first on the main truck, and then, as if its strength was near gone, almost tumbling down the yards to the deck, where it lay feebly fluttering.

A large rough-legged hawk from the Rocky Mountains (*Archibeuto Santi Johannes*) has been given by Dr. Francis Martin, of Boston. It was taken from its nest by the Indians, and is said to be a rare specimen.

Only three elephants remain, and these are kept chained to the hard floor of the antelope house. So nervous this unnatural imprisonment has made them, that now and then one or the other shows signs of

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dangerous excitement. One afternoon last week, when the doors were closed, Snider, the elephant keeper, unchained the biggest of the three, a monster elephant, standing 9 feet 1 inch high, weighing nearly five tons, and second in size only to the late Jumbo. This partiality so angered Tom, one of his mates, that he set up a vibrant trumpeting, jumping up and down angrily, and thrashing his trunk this way and that. A night or two before, he tore his iron-girdled, oak-framed cage to pieces, twisting and breaking the bars of inch iron as though only saplings. So ugly has he come to be, that it will probably be necessary to build an iron cage of double thickness for him.

POSITION OF THE PLANETS IN DECEMBER.

VENUS

is evening star, and heads the December list. Her size and brilliancy increase with every reappearance, as she treads her eastern path, and proves herself worthy of her title—the fairest of the stars. She will be near the moon on the evening of the 5th, star and crescent forming a charming celestial picture in the southwest. At the close of the month she sets more than three hours later than the sun. Venus sets on the 1st at 6 h. 46 m. P. M. On the 31st she sets at 7 h. 55 m. P. M. Her diameter on the 1st is 13″.8, and she is in the constellation Sagittarius.

SATURN

is morning star, and takes the second rank on the monthly annals, for at the close of the month he will rise in the east about a quarter of an hour before Venus sets in the west. He may be known by his vicinity to Regulus, being on the 1st about 7° northwest of the star. Saturn rises on the 1st at 9 h. 44 m. P. M. On the 31st he rises at 7 h. 41 m. P. M. His diameter on the 1st is 18″.8, and he is in the constellation Leo.

MARS

is evening star. The rapidly lessening distance between this planet and Venus is the interesting feature of his progress during the month. The two planets are 15° apart on the 1st, and only 1° apart on the 31st. Mars shins as a dim, ruddy star, northwest of Venus. He makes a close conjunction with the moon on the evening of the 6th, being 15′ south. Mars sets on the 1st at 7 h. 59 m. P. M. On the 31st he sets at 8 h. 1 m. P. M. His diameter on the 1st is 5″.6, and he is in the constellation Capricornus.

NEPTUNE

is evening star, and in his best position for telescopic observation. He may be found about 5° southeast of the Pleiades. Neptune sets on the 1st at 6 h. 16 m. A. M. On the 31st he sets at 4 h. 15 m. A. M. His diameter on the 1st is 2″.6, and he is in the constellation Taurus.

URANUS

is morning star. A telescope will bring him into view about 3° north of Spica. Uranus rises on the 1st at 2 h. 54 m. A. M. On the 31st he rises at 1 h. 2 m. A. M. His diameter on the 1st is 3″.4, and he is in the constellation Virgo.

MERCURY

is morning star until the 28th, when he is in superior conjunction with the sun, and takes rank among the evening stars. Mercury rises on the 1st at 5 h. 57 m. A. M. On the 31st he sets at 4 h. 31 m. P. M. His diameter on the 1st is 5″.2, and he is in the constellation Libra.

JUPITER

is evening star until the 8th, and then morning star. He is in conjunction with the sun on the 8th, and so closely hidden in the sunbeams that he is of little account during the month. Jupiter sets on the 1st at 4 h. 46 m. P. M. On the 31st he rises at 6 h. 8 m. A. M. His diameter on the 1st is 30″., and he is in the constellation Scorpio.

Mercury, Venus, Mars, and Neptune are evening stars at the close of the month. Jupiter, Uranus, and Saturn are morning stars.

PHOTOGRAPHIC NOTES.

Toning Blue Prints.—President C. W. Canfield, of the New York Society of Amateur Photographers, recently gave the following simple formula for toning blue prints, which he had taken from a French journal.

Make a solution of:

Borax	70 grammes.
Water	1100 c. c.

Add sulphuric acid in small quantities until blue litmus paper is turned slightly red.

Then add a few drops of ammonia until the alkaline reaction reappears and red litmus paper is turned blue. Lastly 10 grammes of red crude gum catechu is put into the solution and dissolved, occasionally stirring with a glass rod.

The prints should be printed a shade darker than is desired, and are then toned by immersing in the bath for about five to ten minutes, or until the color has changed. The blue changes to a dark olive green, which in the daytime has all the effect of black. The toning bath will keep indefinitely. Gum catechu can be had at any drug store, and in chemical composition is nearly 50 per cent tannin.

Toning Bath for Gelatino-Chloride Paper.—The following modification of a toning bath has been given by W. H. Stebbins, Jr., of the Amateur Photographers' Society of this city:

No. 1.

Acetate of soda (fused)	40 grammes.
Sulphocyanide of ammonia	20 "
Water	1000 "

No. 2.

Chloride of gold	1 gramme.
Water	1000 "

For use add to 200 grammes of solution No. 1, 60 grammes of No. 2.

Both solutions should be kept separate until used. Heretofore part of the gold solution has been mixed with the sulphocyanide solution, but the improvement consists now in keeping the gold by itself and adding the sulphocyanide directly to the acetate solution. The solutions keep better when prepared as described, and the toning commences as soon as the prints are put in the bath, producing in a few minutes—not over ten—beautiful purple tones.

Professor Tuson.

We regret to announce the death, at the age of fifty-six, of Prof. Richard Vine Tuson, who for the last twenty-eight years has held the post of Professor of Chemistry in the Royal Veterinary College, London.

Prof. Tuson began his scientific training under Prof. Graham, at University College, and was afterward assistant successively to Prof. Ronalds, in Galway, and Dr. Stenhouse, at St. Bartholomew's Hospital, in London. He was afterward elected Lecturer on Chemistry to the Medical School of Charing Cross Hospital, where he was universally popular with students and teachers. A few years later he tried for and obtained the professorship which he held until his death, which took place, in his house at Erith, on the 31st of October, 1888.

Prof. Tuson was a thorough chemist and an able teacher and experimenter. Various scientific papers stand in his name, but his most important literary labor was the new edition of Cooley's well known "Dictionary of Receipts," which he prepared with care and skill. He was a good and most amiable man, and his untimely death, from heart disease—which, it appears, had been making unsuspected progress in his system for years—will be lamented by a wide circle of friends. —*Chemical News.*

Electric Wires in New York.

In a paper read before the National Electric Light Association, Dr. Schuyler S. Wheeler, electrician of the Board of Electrical Control, says the total number of miles of underground wires already laid in New York is 3,697.

The number of miles of underground wire in Brooklyn is 2,100.

The number of miles of underground wire in Paris is 4,100.

The number of miles of underground wire in Chicago is 200.

The number of miles of underground wire in Boston is 400.

The number of miles of underground wire in Pittsburg is about 1,000.

There are already underground, in the city of New York, more electrical conductors than in any other city in the world (except Paris), while the capacity of the subway construction already finished in this city may be estimated fairly at something over 30,000 miles of conductors.

There are through lines completed from the Battery to the Park on the two principal thoroughfares of this city, Broadway and Sixth Avenue, and a gradual conversion of overhead lines to underground lines in the busy parts of the city may be confidently expected.

The Board of Electrical Control is not unmindful, however, of the magnitude of the labor and expense required in converting the present arrangements into underground systems, and does not contemplate either the hampering of the business of electrical companies by forcing unreasonable numbers of wires underground, or by attempting to compel the use of subways faster than is consistent with the efficiency of the various electric service to the public. If the great mass of overhead conductors are removed, and the remainder of the service brought to a condition which will insure the safety of the public, and, at the same time, the benefit of the companies themselves, it will be the result desired by the people of the city, and which the Board of Electrical Control is endeavoring to attain.

As to this matter of regulating the overhead service in the city, I may say that an investigation of all the wires overhead, instituted since I have been connected with the work of the authorities in charge of electrical matters here, by the inspectors appointed after a rigid examination, found competent for the purpose, has shown that a great deal of very bad and unnecessarily dangerous work has been done in New York, and that a reprehensible and inexcusable condition of overhead wires is the principal, if not the only, cause of the clamor for underground service.

In addition to this, an enormous quantity of wire and a large number of poles not in use at all exist, amounting, as has been variously estimated, to from a half to two-thirds of all the wire and poles in the city.

One has no idea of the aerial freebooting that is and always has been going on with overhead wires, until he spends some time seeing what there is overhead. The condition of wires in this city is simply outrageous.

The companies owning wires will not permit each other to make common use of the poles, but will chop off wires owned by others without notice. The telephone people object to the electric light wires on account of the induction. Where there is a line of light wires on their side of the street passing close to their poles, they will not allow them to be made fast. The result of the necessity thus made for extra poles is sometimes four lines of poles on one side of the street. Hence most of the wires swing close to or against the other poles to which they are not attached, and linemen, in climbing them, have to crawl through all the other wires which are not fastened to cross-arms.

Among the cases of dangerous wires and unnecessary obstructions found by the inspectors are full lines of large poles extending over miles of streets, filled with wires which are "open" and out of use, but left standing to save the expense of removal, long lines of poles left standing to preserve right of way, arc light day circuits within reach and with the insulation dropping off, and bunches of dead wires hanging from house tops, etc.

Testing Amber Varnish.

Commercial amber varnish is made by dissolving amber or colophony amber in linseed oil, varnish, and turps. In many cases it is made without the expensive amber, and an analyst is sometimes asked his opinion, whether a sample is genuine, viz., really made with amber. The best way is to try for succinic acid, although even a genuine article only contains small quantities of this substance, as a large quantity volatilizes during the heating of the varnish. The detection is, however, difficult, owing to the nature of the article. Neither boiling with hydrochloric acid nor treatment with alcoholic potash extracts any succinic acid. The author's plan is to treat the sample with nitric acid of 1·20 specific gravity.* He proceeds as follows:

Twenty grms. of the varnish are put into a flask of about 300 c. c. capacity, and heated on a sand bath with 50 c. c. of the nitric acid. When action sets in, the flask must be somewhat cooled to prevent a too fierce oxidation, when it may be again gently heated for about fifteen minutes. The acid, which holds all succinic acid in solution, is now poured off and the insoluble resinous mass washed with water. The acid is evaporated in the water bath, a little water being from time to time added. When the acid has been completely expelled, the remaining sirup is dissolved in about 10 c. c. of water, and this solution shaken with 100 c. c. of ether. After distilling off the ether, the residue is put in a watch glass and put under a desiccator. After about twelve hours, crystals of succinic acid separate out, and the amount gradually increases. The mother liquor being removed by means of blotting paper, the crystals may now be tried by the usual tests for succinic acid. It is thus possible to answer within twenty-four hours the question whether a sample of amber varnish is really deserving of the name.—*W. Sonne, Zeitschr. f. angew Chemie, No.* 18; *L. De K., The Analyst.*

Electro-Plating.

The following method for the electro-deposition of the heavy metals, such as platinum, iridium, palladium, etc., has recently been proposed by Professor Silvanus Thompson. The impure metal is first obtained as a chloride by the ordinary chemical processes. The excess of acid is evaporated off in a water bath, and the salt finally redissolved in distilled water and from ten to fifty times its weight of a solution of sodium phosphate either pure or mixed with borax. The solution is then raised to the boiling point, and sal ammoniac, common salt, or sodium bromide added. The solution is then reheated, and finally neutralized with either the carbonate or, if alkaline, with the bicarbonate of soda. In depositing the metal from a bath of the above solution, it should be heated to from 60 deg. to 90 deg. Cent., and the metal deposited in the ordinary way. In the case of platinum, a brilliant deposit can be obtained from a bath of the following composition:

	Parts.
Chloride of platinum	2
Sodium borate	16
" carbonate	16
Sal ammoniac	2
Water	150

*Note by abstractor.—May not some succinic acid be actually produced by oxidation of fatty matter?—L. De K.

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AN AIR COMPRESSOR FOR VARIABLE PRESSURES.

At the recent meeting of the British Association, Leeds, a paper was read by Mr. Henry Davey "On a New Form of Air Compressor for Variable Pressures," which he has recently designed. It is illustrated and described by *Engineering* as follows:

When compressed air is stored for power, for blowing fog signals, or for other purposes, the work to be done is to fill receivers to a high pressure, beginning with a low pressure. Taking the case of a minimum of 20 pounds and a maximum of 200 pounds per square inch, it is evident that if an ordinary air pump were made so

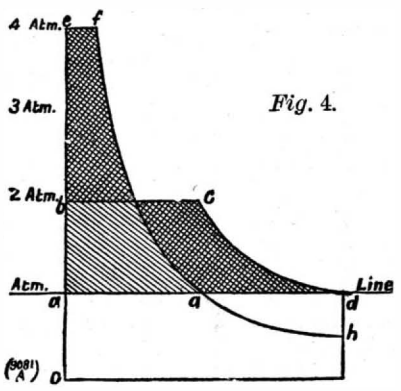

Fig. 4.

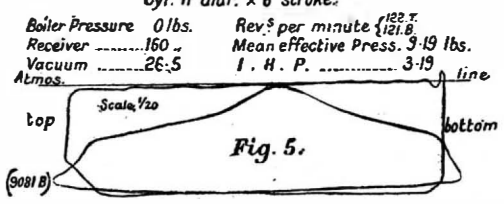

Fig. 5.

large that it would take up all the power of the engine at 20 pounds, it would be too large for any other pressure, and enormously too large for the 200 pound pressure. The old plan was to have two or more pumps, of different sizes, and put one or more pumps in gear with the engine, as the pressure varied. The plan was, however, complicated and non-automatic in its action. Mr. Davey's new pump is capable of being made of sufficient size to take up the full power of the engine at the lower pressure, automatically suiting its action to any higher pressure it may encounter, always utilizing the full power of the engine. By making the quantity of air to be compressed per stroke to vary inversely with the pressure, the air pump will encounter a constant resistance with varying pressures. The area of the air pump diagram should remain constant, as illustrated by the diagram, Fig. 4. The explanation of the diagram was given by the author as follows: Let the receiver pressure be two atmospheres, then the compression diagram would be a, b, c, d; but should the receiver pressure be anything greater, say four atmospheres, then the compression diagram would be a, e, f, g; the areas of the two figures being exactly the same, and that holds good for all pressures. In the first case the air pump would have taken in a full charge of air. In the second the supply of air to the pump would have been cut off at the point g, a partial vacuum being formed while the piston moved from g to h, the air being compressed along the same line on the return of the piston from h to g; the action and reaction, as far as this part of the curve is concerned, being equal.

The pump is proportional in size to the lower pressures and in strength for the higher pressures. At the first it takes a full charge of air during the suction stroke, but as the pressure rises, the admission on the suction stroke is cut off before the end of the stroke by means of a governor. The engine itself has no other governor than the resistance of the air pump. The steam is always full on, so that the maximum work is always got out of the engine.

In our illustrations, Figs. 1 and 2, a Davey hopper boiler and motor combined are shown with an air pump attached. This is one of several sets which have been made for working fog signals; a position in which the pressure often varies from 20 pounds to 200 pounds per square inch. The pump is reversible, and may be made an exhauster for producing various degrees of exhaustion. The combination of motor and hopper boiler make it especially applicable for working the pneumatic dispatch in offices and other places. Even with constant pressure the plan is valuable, because it admits of the employment of the largest air pump possible, which, if too large, adapts itself to the power of the engine. The compressors illustrated have been made to the order of the Trinity House authorities, to place on the Bishops Rock Lighthouse. They are, as stated above, worked by a pair of Mr. Davey's safety motors with hopper boilers. The base of the motor forms the surface condenser, which is kept cool by natural circulation from a tank formed on the parapet of the lighthouse. Fig. 5 shows diagrams from one engine. We may add that a pair of Mr. Davey's 10 horse power motors with compressors have been working the fog signals on the Kentish Knock Lightship for some time past.

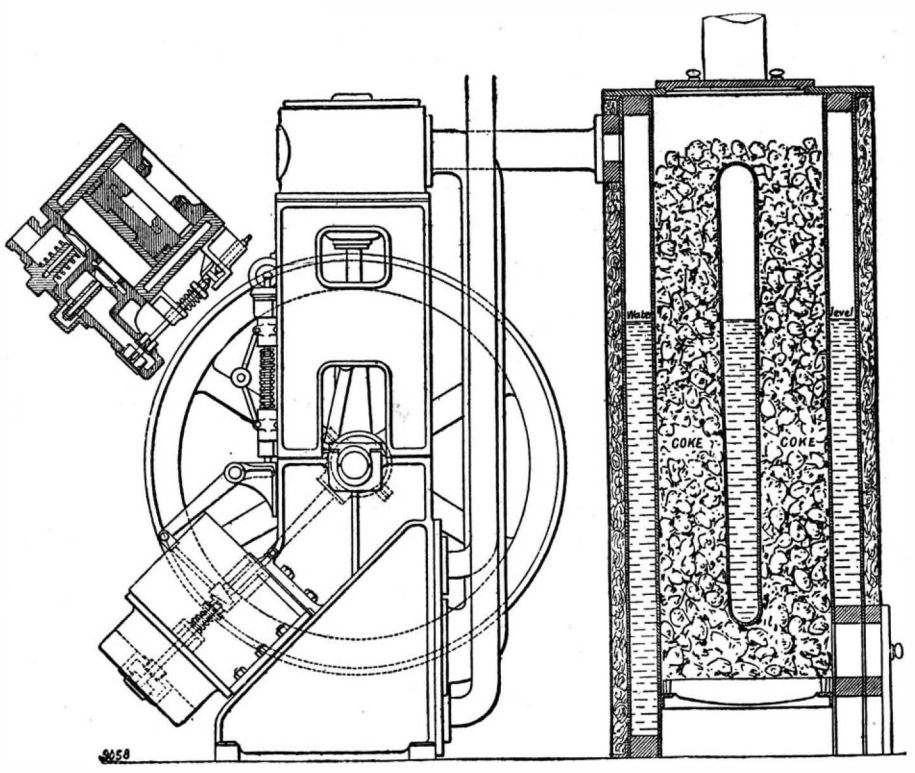

Fig. 3. Fig. 2.

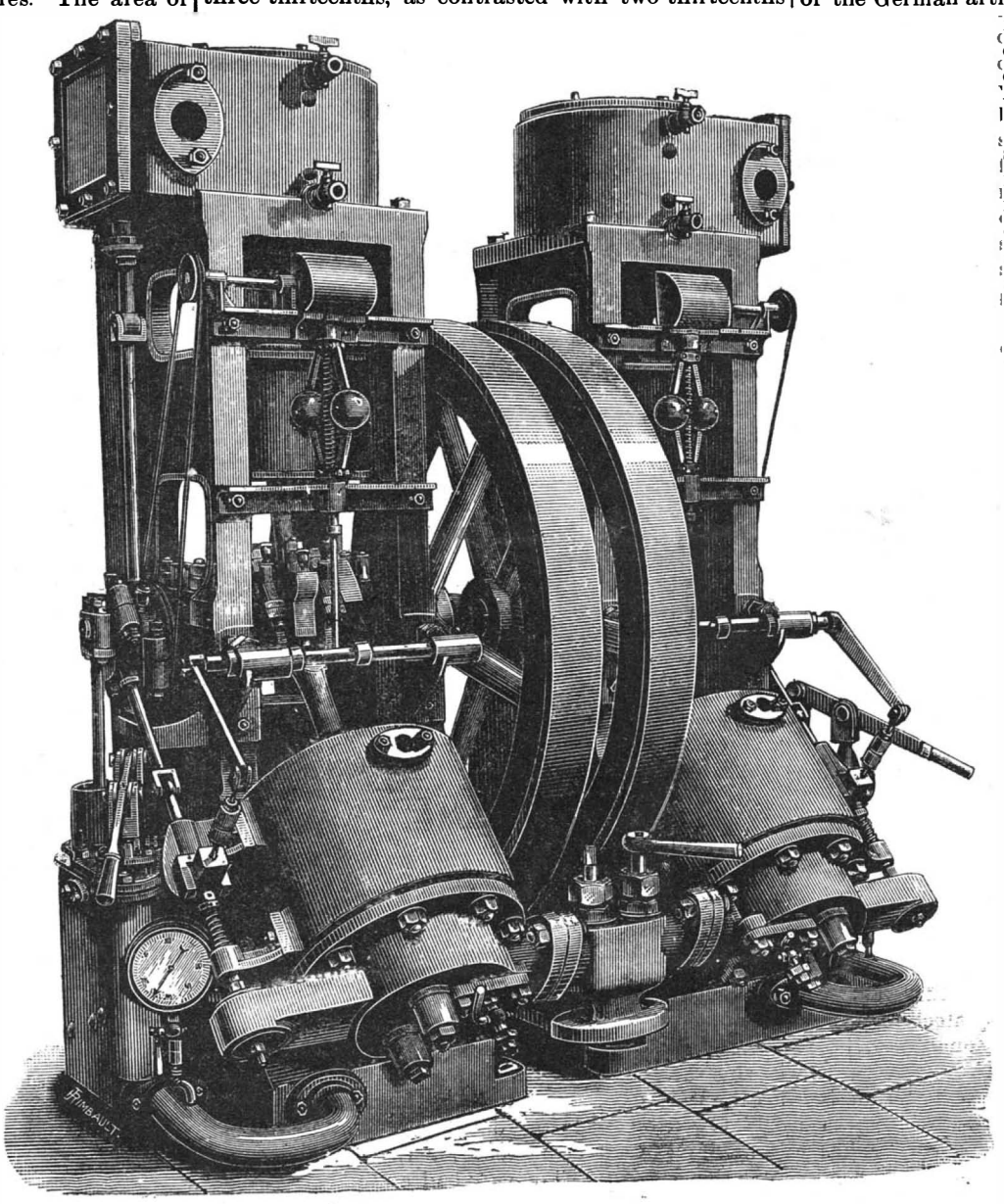

Fig. 1.—DAVEY'S MOTOR AND AIR COMPRESSOR FOR VARIABLE PRESSURES.

Our Foreign Flour Trade.

Of the total British import of flour in the first nine months of this year, amounting to 12,908,322 hundredweights, the United States supplied 10,174,675 hundredweights, or between four-fifths and five-sixths. This, too, at a time when the complaints of the trade of small business have been long, loud, and deep. This flour exportation from the United States has been about 1,100,000 hundred weights less than for the same time last year; but, on the other hand, Great Britain's imports were some 400,000 hundredweights larger in 1887, which diminishes the disparity in the percentage considerably. So we find that Great Britain has taken some ten-thirteenths of her flour supplies from us this year, as against a little less than eleven-thirteenths last. Her supplies from all other sources so far this year have thus been about three-thirteenths, as contrasted with two-thirteenths last. Great Britain is experiencing a revival in her milling trade which is quite remarkable. Not only are old mills being improved and started up, but new ones are being built to some extent, and in many cases of good size.

It is very probable that in the ordinary state of things we should be able to undersell these mills largely on their own grounds, for this is what we have been doing for years past. But we have to consider that it is not the large and improved British mills which have suffered so greatly from our competition, but the small and old-fashioned ones. In case the work of remodeling becomes general throughout the kingdom, and the average British mill is put on a basis with the average American mill, as to mechanical construction, the whole question of our ability to compete will depend on comparative cheapness of the raw material.—*Northwestern Miller.*

Changes in the German Artillery.

The *Allgemeine Militar-Zeitung* announces as probable several considerable changes in the organization of the German artillery, to be effected from April 1 next. The field artillery will become an integral part of the army corps, its inspectorates and staff will be suppressed, and there will be created in their place a new and supreme authority to control the force, but dealing solely with technical questions. Some reduction in cost will thus be secured, but the saving will probably be more than swallowed up by the increase in guns, carriages, etc. Our contemporary gives also some particulars of a curious experiment that is being made with a view of enabling artillery to approach the enemy and act effectively in difficult situations. It is proposed to place two different guns on one carriage, the first an ordinary field gun of eight or nine centimeters, the other a mortar of eight centimeters. These will be fixed in opposite directions, and a rotary movement can be given to the supporting framework, so that either can be used. Further details are not yet made public.

Is Dry Rot Contagious?

There appears to be such a thing as a diagnosis of disease in wood, and the botanical physicians, according to the *Northwestern Lumberman*, profess to know that it may be contagious or sporadic. Dry rot is called contagious, and it is said that the germ of that disease may be communicated to sound wood by tools which have been at work in diseased wood. It is thought possible that this theory accounts for many incomprehensible breakages of timbers. The suggestion is that sound lumber should not be cut with the same saw that has passed through stuff affected by dry rot without cleaning.

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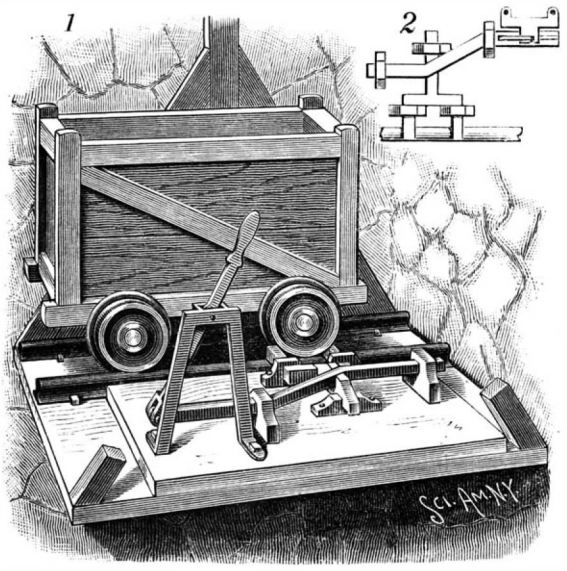
AN IMPROVED CAR STOP.

A simple device for restraining mining or other cars from movement on the tracks of hoisting carriages in mining shafts, etc., is illustrated herewith, and has been patented by Mr. William Walker, of Jermyn, Pa. On a base plate adjoining the car rail are guides, in which are mounted to slide across the rail the rigid arms of a forked chock block, adapted to catch both sides of the car wheel, the chock block being pro-



WALKER'S CAR STOP.

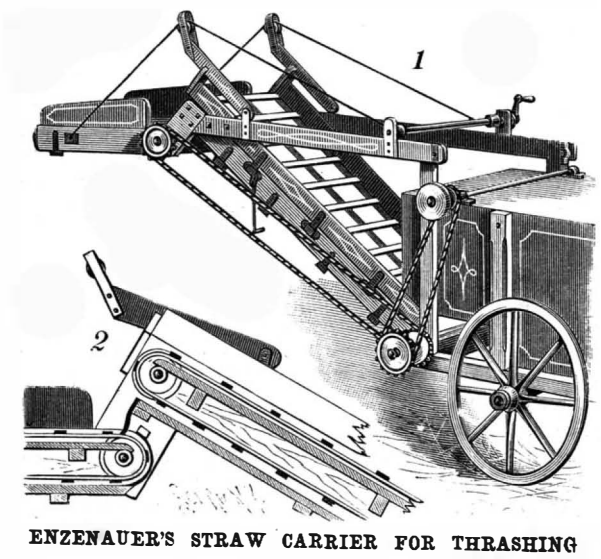
jected and retracted by means of an upright handle lever pivotally connected with a cam bar, arranged at right angles to the direction of motion of the chock block.

Additional Water Supply Required for New York.

Mr. Church, chief engineer of the Croton aqueduct, in a recent report to the commissioners, fixes the probable date of the completion of the new aqueduct to its connection with the old aqueduct mains in Tenth Avenue, near 135th Street, at July 1, 1889, and to the Central Park reservoir at December 31, 1889. For the maximum supply he gives the approximate figure of 318,000,000 gallons. In 1890 Mr. Church estimates that the city will have a population of 1,665,875; and, according to the tables of statistics which he presents, he demonstrates that the consumption will exhaust the storage of that year, and the daily supply will be short 79,600,000 gallons.

IMPROVED STRAW CARRIER FOR THRASHING MACHINES.

A machine whereby straw, chaff, etc., may be delivered, without spilling, to the stacker from the separator, is illustrated herewith, and has been patented by Mr. Peter Enzenauer, of Red Bud, Ill. The carrier is made in two hinged sections, the lower or main one being attached to standards forming a rear portion of the separator, and held at an inclination by side braces, while the upper section, when the carrier is not in use, may be folded under and held in folded position by hooks. The carrier has parallel side pieces, with a rigidly attached bottom, an upper floor being secured to the side pieces to afford a space above the bottom, and a curved metal plate inclosing the lower end of the



ENZENAUER'S STRAW CARRIER FOR THRASHING MACHINES

body, at each end of which a shaft is journaled, carrying an endless belt. The straw or chaff carried by the belt over the upper floor section, and not falling into the short section, drops into the space between the bottom and the upper floor of the carrier, and is carried by the lower section of the belt to the floor or table, to pass upward with the main body of the material, there being an apron to prevent any of the material carried upward by the belt of the main section dropping into the space between the upper floor of the short section and the end plate.

London Fogs.

As these lines are being written (says the *Journal of Gas Lighting* of Nov. 6), London lies literally gasping for breath under one of the blackest and most persistent fogs that have ever visited the valley of the Thames. It is a perfect example of that variety of the London fog which has been distinguished of late years from the traditional "pea soup" fogs so clearly described by Dickens in his tales of London life. We still get too many specimens of this type of fog to forget what it is like. It is the thickness of what has to serve for air, which makes the eyes smart and weep, chokes respiration, and blurs the visual aspect of outer objects. Lights are almost powerless to penetrate this mixture of mist and smoke. Scarcely can the wayfarer see one street gas lamp at a time; he certainly cannot see the second. Drivers of vehicles are compelled to lead their horses, and make sure of their course by observations of the curb of the street pavement; and when they have to navigate a wide crossing, they must trust to fate for getting to the corner for which they aim. The usual street noises are either hushed or strangely muffled and changed; but the improved acoustic properties of the thickened atmosphere are witnessed to by the startling distinctness of sounds usually unheard or diminished. All this, be it remarked, is characteristic of an old-fashioned yellow fog, which strangled our forefathers in the streets of London just as it does their successors to-day. The "London particular," however, is no longer confined strictly to the metropolis. The growth of towns in different parts of the country has prepared conditions as favorable to the development of the densest kind of fogs as used to be found in London alone; and consequently, at the present day, Manchester and other places are occasionally plagued with fogs which do not yield in vileness of character to anything that London can show. The other variety of fog, which we have already remarked as distinct from this deadly mixture of antique repute, is not so thick upon the ground, but is much blacker overhead. It does not so acutely affect the eyes or the lungs, and in this respect is more endurable; but no words can adequately describe the gloom where it enthrones itself on the housetops. To look up toward what should be the open sky is like gazing into a coal cellar. Wayfarers flit along the streets like disembodied spirits, and vehicular traffic is carried on as though in a cavern. The general aspect of the streets and shops is much the same as that presented on a murky, wretched night. The window glass seems dirty, and the gas looks bad, yet comfortable, for everybody hastens to light up in order to dispel the unnatural dusk. If a fog of this kind were to happen at night, it would not be very noticeable except for the deadness of the air, which renders breathing unpleasant, although not in the same way as a pungent yellow fog. The influence of the invisible carbonic acid, which is probably present in abnormal proportion in the stagnant air, is sensibly felt by all animate beings. This and the blackness at midday combine to make London in a fog of the kind now under notice a place to be shunned during the continuance of the infliction. Fortunately, these fogs are frequently very local, and the slightest movement of the air clears them away.

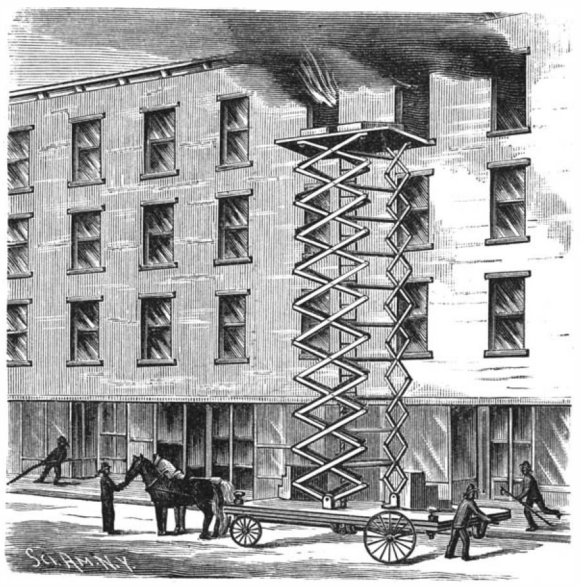
Balls of Earth on Evergreens.

It is more essential to retain balls, or rather cakes, of earth on the roots of evergreen trees in removing them than for deciduous trees, because the roots of the latter will bear longer exposure to the air. Where the distance for removal is short, or from one part of the grounds to another, there is no difficulty in carrying large masses of earth on the roots, and in preventing any failure in the operation. Evergreen trees may be carried several miles in a spring wagon, or on a sled in winter, if there is enough earth adhering to the roots to hold them upright during the transit. There will be no difficulty for trees six or seven feet high, but more care and labor are required for those much larger. We have conveyed twelve-foot trees of the white pine several miles without any loss. They were taken from the borders of a wooded swamp, the rich muck in which they grew resting on hardpan eight inches below, and allowing the muck, which held all the roots, to be lifted easily with the tree. This is the best condition of soil for taking up masses of earth with the roots, and has always been attended with moderate labor and entire success with arbor vitæ, hemlock, and other evergreens. When the trees stand on a gravelly soil alone, the difficulty of taking them up is much greater.

These remarks do not apply to small nursery trees two or three feet high, which have been prepared for removal by previous transplanting, or to larger evergreens which have been several times transplanted, and on which the balls of earth are of less importance. When this previous preparation has not been given, it is a good plan in late autumn to fit them for a second or third year's removal by digging a trench around them at a proper distance and deep enough to cut off all the horizontal roots, and then filling it again. Every root thus cut sends out a number of fibers, which are of more value to the tree in removal than a single long root.—*The Cultivator.*

AN IMPROVED FIRE ESCAPE.

A portable fire escape, constructed with three systems of lazy tongs connected together and arranged to be elevated and lowered by a screw mounted in the platform of a truck, is illustrated herewith, and has been patented by Mr. Louis P. Santy, of Clements, Kansas. The platform on which the tongs are mounted has screws at its corners, whereby the escape may be held upright or tipped against the walls of a building. The



SANTY'S FIRE ESCAPE.

tongs are united by a series of triangles, a set of lazy tongs being arranged at each corner of the triangle, each set bracing the others. A screw for elevating the system is mounted in the center of the platform, a triangular plate being attached at its corners to the lowermost set of lazy tongs, and having at its center an internally screw-threaded boss in which the screw works, being operated by beveled gears and crank shafts extending to the ends of the truck. By turning the cranks the three sets of lazy tongs will be rapidly elevated, and by reversing the motion as rapidly lowered. At the top of the lazy tongs is a platform or cage on which persons may step from the window of a building, and be lowered to the ground by turning the cranks, or they may descend by a rope ladder suspended from an aperture in the center of the cage.

A SIMPLE CHURN DASH.

An improvement readily applicable to almost any form of churn, and by which it is designed to make fine flake butter quickly and with little labor, is illustrated herewith, and has been patented by Mr. Lambert Snyder, of Midland Park, N. J. It consists of a dash loosely hung upon a bracket in the lid of the churn, a double conical frame being hung upon the stem of the dash, the apex of one cone being at the lower end of the frame, while that of the other cone is above, and designed to come near the surface of the milk. The vertical pieces of the frame have each a longitudinal slot, which, with the cross bars and pins, are designed to cut and break the cream as the dash is rotated. The upper end of the dash spindle has a grooved pulley, through which

SNYDER'S CHURN.

the dash is reciprocated by means of a bow, the cord of which is easily sprung into the groove of the pulley to make one complete turn thereon, and requiring but little tension. The device is so simple that it is not likely to get out of order, can be readily cleaned, and is easily operated. As the dash rotates in opposite directions, with each stroke of the bow, the frames draw the cream from the top and bottom toward the center, where it is broken by the rods and cut in its passage through the slots in the frames. The device is cheap of construction, easy of manipulation, and efficient and rapid in action.

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Bellite.

An ideal explosive for engineering purposes would naturally require to be flameless, perfectly safe in handling, and, although slow in action, exertive of extreme energy, so as to bring down huge masses of rock or coal without shattering, as unavoidably results from using quick explosives, such as dynamite and others of the nitro-glycerine group. The experiments we had the privilege of watching recently at the Clarence Iron Works, Middlesborough, were mainly intended to demonstrate that in the new Swedish compound, bellite, the invention of M. Carl Lamm, the managing director of the Rotebro Explosive Works, Stockholm, science has secured what practically amounts to an ideal explosive. For the manifestation of this point the programme drawn up by Mr. Napier Hake, F.I.C., who conducted the trials, was excellently conceived, and the numerous civil engineers, owners of collieries, and chemists present appeared to be pleased. Of course, we possess explosives of far higher potency, and others that are fairly safe to use, but hitherto the complaint against the former has been that they act too rapidly, destroying locally all adjacent; while, with one or two exceptions, the safer compounds have not exhibited any phenomenal disruptive force.

The first test to which bellite was submitted was almost crucial, as regarded the problem of security, half a ton weight of iron being dropped 20 ft. on to a packet of cartridges, resting on a thick iron slab, without producing explosion, while, beyond causing breakage, the ignition of 1 lb. of gunpowder inside a paper parcel containing naked cartridges proved similarly harmless. Nor was the fire experiment less successful, a lump of bellite thrown on cinders blown to a white heat merely melting or fusing away with scarcely appreciable ignition. In each case, it should be said, a second experiment was made to prove that the explosive itself had been submitted to the previous test.

Perhaps more interest attached to the next series of trials, in which bellite competed with dynamite, the object being to show that while exerting even greater force than Mr. Nobel's discovery, the new Swedish explosive diffused its energy over a wider surface—in other words, the gases generate a little more slowly. These successive tests were made upon ⅜ in. boiler plates and 70 lb. iron rails in fairly good condition, the charges ranging from 1 oz. to 4 oz., being laid upon the plates, and in the case of the rails—resting on their sides—on the web. In most instances the charges were tamped with a handful of wet mud, but in two tests were exploded without any covering except the usual wrappers. With regard to these latter, dynamite must be considered to have had the best of it, its quicker action bursting a small hole through the plate, and also through the rail web, the competing explosive merely causing extensive bulging with prolonged fracture. In all the other trials, however, bellite produced much the most damage, the surface injured or wrecked being some 30 per cent greater.

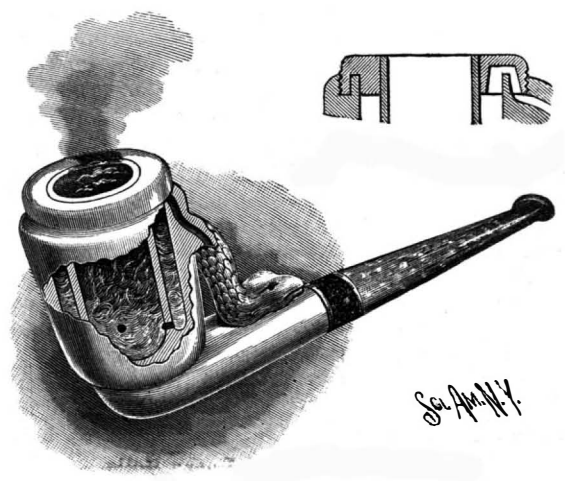
An earlier test, which had failed, namely, exploding a bellite cartridge upon the ⅜ in. to ½ in. lid of a deal box filled with the same, and which resulted in the explosion of the contents, was now repeated on a ¾ in. lid successfully, the box being merely broken to pieces and the cartridges inside fractured and dispersed; the first day's proceedings ending with the explosion of earth and submarine mines, 3 lb. of bellite raising masses of earth to a height certainly not less than 100 ft., and probably half as high again, and leaving a hole found on after measurement to be 11 ft. in diameter, and nearly as deep to the loose earth. The submarine explosion was equally effective.

The second day's experiments were made in the ironstone mines at Middlesborough, owned by Messrs. Bolckow, Vaughan & Co., and, in the opinion of the experts present, were absolutely successful, the stone being thrown out in large and easily removable blocks, while the absence of offensive gases was particularly remarked. In regard to the other claims advanced for bellite, namely, its flameless character and security against explosion by lightning or electricity, no opportunities were afforded for forming a conclusion, but the fact that it is carried as ordinary merchandise in Sweden leaves little room for doubt as to the sufficiencies of previous tests in these directions. During the first day's trials a distinct flash was visible when dynamite was exploded, but not so when bellite was discharged. The new explosive is a compound of nitrate of ammonium with di- or tri-nitro-benzole, in the proportions of about five of the former to one of the latter.—The above is from the *Engineer*.

Bellite, says *Industries*, closely resembles roburite and gremite, and consists of five parts in weight of nitrate of ammonia, mixed with one part of di- or tri-nitro-benzole, and is manufactured either in the form of a loose powder, yellowish in color, or in compressed cartridges; and in taste and smell is similar to the nitrate of ammonia of commerce. It is claimed for bellite that it is more powerful than gun cotton or dynamite; cannot be exploded by shock, pressure, lightning, electricity, friction, fire, or indeed under any conditions except by aid of a detonating cap, and is, therefore, perfectly safe; gives off no offensive gas, as with dynamite and other nitro-glycerine compounds; is entirely flameless when exploded, and can, therefore, be safely used in coal mines; presents no danger in manufacture even in tropical climates, and in Arctic cold requires no thawing; is absolutely safe in transport, and is, in fact, carried by the Swedish railway companies as ordinary merchandise; and when made expressly for subterranean blasting, does not shatter like dynamite, rather forcing the coal or rock out in large blocks, and causing but a small percentage of dust. It is further claimed that bellite shells might be fired from ordinary cannon, without the slightest fear of the concussion produced by igniting the gun charge exploding the shell and bursting the gun.

AN IMPROVED SMOKING PIPE.

A pipe designed to extract the nicotine from the smoke before the latter enters the stem, and wherein the smoke will be cool upon reaching the mouthpiece, and dirt and sediment will be prevented from settling in the stem, is illustrated herewith, and has been patented by Mr. George H. Wartman, of Montesano, Washington Territory. The bowl has a central receptacle for tobacco, which may be detachable if desired, and there is an annular chamber between the inner walls of the bowl and the outer walls of the tobacco receptacle, adapted to be ordinarily filled with cotton or other equivalent, there being small apertures in the sides of the tobacco holder, allowing the smoke to be drawn therefrom through the cotton. The neck to which the stem is attached has a channel connecting with an annular groove in the upper edge of the



WARTMAN'S PIPE.

bowl, formed by the rim or cap shown in the sectional view. This construction is especially adapted to meerschaum or other bowls to be colored, as the heated tobacco does not come in contact with the bowl.

Chimneys for Boiler Plants.

Referring to the 335 foot chimney of the Clark Thread Company, at Newark, N. J., which of late has been very widely noticed, as being probably the tallest boiler chimney in the world, and which was illustrated in the SCIENTIFIC AMERICAN, Oct. 20, 1888, calls to mind the fact that a large number of chimneys now in existence are of much greater height than the requirements actually call for. There seems to be a prevailing notion that the greater the height the greater, in direct proportion, the draft-producing power of a chimney—a most natural error perhaps on the part of the average power men, but, at the same time, one which has been responsible for much unnecessary outlay in chimney construction. As a matter of fact, the draft-producing capacities of chimneys, having flues of the same size, are in proportion to the square roots of their heights, so that if one was to have double the power of the other, it would have to be four times as high. Attention has been more than once directed to the circumstance that beauty of design, from an architectural point of view, has had much to do with the unnecessarily great heights so frequently encountered, a much favored rule being to make the height of the chimney equal to about 25 times the diameter of the flue. A little consideration will show that by rigidly adhering to this ratio some rather peculiar results will be reached, chimneys for small plants turning out to be much lower, and those for larger boiler plants becoming much higher than is necessary. The area of cross section of the chimney flues in all cases should be made to depend upon the combined areas of the boiler flues, and this with a height of stack of 100 feet, shown by extended experience to be a very satisfactory figure, will furnish ample draft to burn any of the commonly used fuels. Applying the 25 to 1 ratio to two plants of say two and ten boilers respectively, all of the same size, and proportioning the flue areas of the chimneys in the way we have just indicated, will afford a very striking illustration of the shortcomings of the rule. One hundred and fifty feet represent what has on good authority been given as the maximum height of chimney necessary in any case for producing the requisite draft, always provided, however, that the flue area has been properly proportioned. Proprietors of steam plants boasting of chimneys which must exceed this figure in height may indulge in some profitable reflections as to the money needlessly spent in having such structures raised.—*The Iron Age*.

The Dreams of a Hasheesh Smoker.

Science describes the experiences of a gentleman who placed himself under the influence of hasheesh. He smoked it until he felt a profound sense of well-being, and then put the pipe aside. After a few minutes he seemed to become two persons; he was conscious of his real self reclining on a lounge and of why he was there; his double was in a vast building of gold and marble, splendidly brilliant, and beautiful beyond all description. He felt an extreme gratification, and believed himself in heaven. This double personality suddenly vanished, but reappeared in a few minutes. His real self was undergoing rhythmical spasms throughout his body; the double was a marvelous instrument, producing sounds of exquisite sweetness and perfect rhythm. Then sleep ensued, and all ended. Upon another occasion sleep and waking came and went so rapidly that they seemed to be confused. His double seemed to be the sea, bright and tossing as the wind blew, then a continent. Again, he smoked a double dose, and sat at his table pencil in hand, to record the effects. He lost all conception of time. He rose to open a door, and it seemed to take a million years. He went to pacify an angry dog, and endless ages seemed to have passed when he returned. Conceptions of space retained their normal character. He felt an unusual fullness of mental impressions—enough to fill volumes. He understood clairvoyance, hypnotism, and all else. He was not one man or two, but several men living at the same time in different places, with different occupations. He could not write one word without hurrying to the next, his thoughts flowing with enormous rapidity. The few words he did write meant nothing.

Cocoanut Fiber as a Defensive War Material.

In the last report of the Curator of the Nilgiri Gardens attention is drawn to a new use for the refuse fiber of cocoanuts. Dr. Lawson says that his attention was drawn to the subject by Mr. Money, a planter in the Nilgiris, who sent him an article in the *Revue des Deux Mondes* for August 1, 1886, by M. De la Barriere, entitled "Batiment de Combat et de la Guerre," in which the author described how the refuse of cocoanut, after the process of retting, might be used for backing the iron plates of ships of war. The method of proceeding was to take a quantity of the powdered refuse before it was quite dry, and subject it to pressure, when the natural viscidity of the macerated cellular substance of the nut caused the whole to cohere and to form a plate, which in general appearance was like a mill-board, only much more brittle.

Owing to the hygroscopicity of this substance, if a hole is made through it, the parts adjacent to the puncture absorb water, swell up, and immediately close the orifice. Dr. Lawson got a sack of this refuse and made a plate 18 in. square by about ¾ in. in thickness, which he placed between two boards, and then fastened it to one side of a box, which contained a head of one foot of water. A bullet half an inch in diameter was fired through it, but not a drop oozed out. This experiment was repeated three times with the same result. Then a ¾ in. bullet was fired through the plate, when a few drops only made their way through. Lastly, a bullet nearly 1 in. in diameter was fired through the plate, when a large jet of water shot through, but in the course of a few seconds the stream decreased in volume, and in less than a minute had ceased to flow altogether. Whether or not this material could be advantageously used for the purpose which M. De la Barriere suggested, or for any other purpose, is a matter worth considering, for, as he truly says in his article, millions of tons float away annually down our rivers in India.

Deep Sea Soundings.

Her Majesty's surveying ship Egeria, under the command of Captain P. Aldrich, R. N., has, during a recent sounding cruise and search for reported banks to the south of the Friendly Islands, obtained two very deep soundings of 4,295 fathoms and 4,430 fathoms, equal to five English miles, respectively, the latter in latitude 24 deg. 37 min. S., longitude 175 deg. 8 min. W., the other about 12 miles to the southward. These depths are more than 1,000 fathoms greater than any before obtained in the Southern Hemisphere, and are only surpassed, as far as is yet known, in three spots in the world—one of 4,655 fathoms off the northeast coast of Japan, found by the United States steamship Tuscarora; one of 4,475 fathoms south of the Ladrone Islands, by the Challenger; and one of 4,561 fathoms north of Porto Rico, by the United States ship Blake. Captain Aldrich's soundings were obtained with a Lucas sounding machine and galvanized wire. The deeper one occupied three hours, and was obtained in a considerably confused sea, a specimen of the bottom being successfully recovered. Temperature of the bottom, 33·7 deg. Fahr.

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THE MONITOR TERROR.

The vessel illustrated in the present issue is the successor of one of the monitors of the civil war. While she is really a new ship, she was started under the law authorizing the repair of the old Terror. In 1872–73 operations were commenced, and were interrupted to such an extent that it is only at the present day that she approaches completion. As will be seen by examining the illustrations, she is a double-turreted monitor, armed with four guns in the turrets. She is 261 feet long over all; between perpendiculars she is 250 feet long. She is 52 feet 6 inches wide and 17 feet deep. Of this depth 2½ feet are freeboard, or above water. Her sides are protected by a 6 foot belt of armor, 7 inches thick. This armor, therefore, extends 3½ feet below water. The deck has a slight crowning, amounting to 8 inches, and is of 1¾ inch iron. It is not in any sense deflective.

Up to this point most of the vessel is of iron. The turrets are to be of steel. For most of their circumference they are 10½ inches thick, but for a short space on each side of the guns they are one inch thicker.

The conning and sighting tower for use in action is on top of the turrets and is 4 feet wide and 2 feet high inside. Its sides are 12 inches thick. The guns are directed by sights upon the turret, the artillerist not seeing the piece whose firing he is directing. Each turret contains two 10 inch breech-loading rifles.

Hydraulic lifting apparatus is provided, to raise the shell and powder from the hold, and to force it into the breeches of the guns. The powder is contained in two cases, to avoid too great a length, on account of the limited room.

The guns are strapped fast to the carriages, and for loading the breech of the gun, carriage and all are swung downward. This operation is also executed by hydraulic power.

The turrets are of the English type. They rest on coned rollers, and are rotated each one by two Brotherhood engines, which rotate with them. All around the turrets an annular space, 4 inches wide, is left between them and the decks. This is closed by a heavy sheet of India rubber, so as not to interfere with the movements of the turrets.

The smoke stack and ventilating shaft are both armored with 9 inch plating for 6 feet above the deck.

She is propelled by twin screws, driven by Whiting patent engines of 1,500 horse power. She is of 3,800 tons measurement, so a rather low speed will be attained.

The hull was built at Cramp's ship yards, Philadelphia. It now lies at the Brooklyn Navy Yard, awaiting completion. Work is rapidly progressing, and it will soon be ready for service.

The guns, projecting for nearly half their length from the turrets, seem to offer a weak point, but they form after all a small target. In the old monitors, using the short guns of the period, they were entirely housed within the turrets.

New York Passenger Traffic.

The New York *Sun* has recently collected some statistics of the passenger traffic in and about New York. It is found that 1,672 regular passenger trains leave the stations of New York, Brooklyn, and Jersey City every 24 hours. The Long Island road's summer service runs on its various lines 577 trains daily. The next largest business is done in the depot of the Erie in Jersey City, where 288 trains daily enter and leave, and there are 216 in and out of the Grand Central depot, and 204 in and out of the Pennsylvania depot. Between 7,000 and 8,000 cars are employed daily in this traffic, and it is said that the number of people who entered and left the city by rail during the year ending May 1, 1888, was 40,188,000. Of this number the Long Island road carried about 8,000,000, the Pennsylvania 6,367,000, and the passengers entering and leaving the Grand Central depot in the same year were 8,881,000. The daily average of passengers in and out is 110,000. It is said that the Long Island road carried 98,000 people to Coney Island on the 4th of July. The busiest moment in the evening is at 5.40 o'clock. At that instant ten trains simultaneously leave the various stations. In the fifteen minutes between 5.30 and 5.45 fifty trains in all go out. The busiest single hour is from 5 to 6 P. M. The busiest moment in the morning is 8.45 o'clock, when nine trains enter the stations simultaneously.

The Black Walnut.

Daniel B. Emerson, Beloit, Wis., has given his experience in black walnut culture. He prefers shallow planting, seven feet apart each way, if planted in a field, or sixteen feet apart if planted around fences, as wire fences can be attached to the trunks without injury. Under favorable circumstances, the trees begin to bear in about seven years. One bushel contains from 400 to 600 nuts, or fifteen pounds of kernels, which will yield seven and one-half pounds of oil. He has trees fifteen years old which are thirty feet high and a foot through at the base. They yield ten bushels of nuts each annually, worth $4. The leaves and the husks, when boiled, furnish a liquid which will kill worms and insects on lawns, without injuring the grass.—*Lumberman.*

Correspondence.

The "White Ring" Black Snakes.

To the Editor of the Scientific American:

In the article on the black snake in your issue of the 6th Oct., and in the comment on it in the issue of the 27th Oct., there may possibly be a misunderstanding of terms. The first article referred to a *racer* with a white ring around its neck, and so far as I know was correct. The second gentleman is surely correct in his statement, and in his belief that there are large black snakes with white rings. I have caught three of the kind he describes, and they certainly belong to the black snake family. Their intensely black skin makes the white ring very prominent. These I captured in West Virginia, so they are not confined to any one locality. However, I doubt if this variety ever attains any considerable size. While traveling in Ohio in 1882, I caught a black snake over five feet in length, and he also had the ring around his neck, the only perceptible difference being in the color, this one approaching yellow. He was the most fearless snake ever I met. He allowed me to go on all sides of him, only moving enough to watch me closely. If this class is not generally known to naturalists, a specimen could easily be procured in Lancaster County, Ohio, for, as I was informed, they are rather common there. In regard to snakes chasing people, I am satisfied there is much exaggeration, but I know such a thing has happened. I am personally acquainted with a lady whose veracity cannot be doubted, and who is not so excitable as to see a snake where there is none, who was chased by a racer black snake for more than a hundred yards, in fact into her yard. At this point he turned and fairly darted away. Of course he could have caught her easily, but he did not. His motive, if it may be called by that name, must for the present be mere conjecture, but the fact remains, and his wanting her for food or not does not change it in the least. I have seen a colt chase a calf, and have no idea that it meant to eat the calf. It is believed by some of our best, or at least most popular, naturalists that a snake has a very low degree of intelligence. He can easily be trained to perform acts not natural to him, and it seems to me that in chasing a person his motive may be very similar to that which in higher creatures is called sport.

W. A. HARSHBARGER.

Franklin, Neb.

The Manufacture of Large Bells.

It may not be generally known, says a writer in *Stoves and Hardware*, that there are only five concerns in the United States engaged in the manufacture of church, school, and chime bells, and that the Hy. Stuckstede Bell Foundry Company, St. Louis, claims to be the largest of the five. In fact, it is not an industry that calls for many factories, as a well made bell will last almost forever, and hence but little has ever been said about them in public print. Nevertheless, the process of manufacture is one full of interest, and worthy of more than passing notice.

A visitor to a bell foundry where nothing but large bells are manufactured experiences peculiar, if not weird, sensations. Not many workmen are employed, and as they move around, with apparently noiseless motion, occasionally stepping in the full light of the open furnace door, showing their begrimed faces, and all the while the soft, resonant tones of the bells being tested, in his ears, the impression is one far removed from churches and church chimes. There is no conversation or badinage, or loudly expressed orders, for the workmen's duties keep them separated, and, as the floor is of clay, there is not even the sound of a footfall. This is the first impression received by a *Stoves and Hardware* representative on his visit to the works above mentioned. A casual glance gave no indication of the work being done. A lot of bells, of various sizes, distributed over the floor, a larger number of moulds, a pile of cast iron mountings, and a furnace with a deep pit in front of it is all that is to be seen, yet here some of the finest chimes in this country have been made.

Contrary to the popular idea, the exact musical tone of a bell depends neither upon the metal nor upon any change in it after being cast. If the bell should not be of the exact pitch, there is no alternative but to melt it over and recast it until the proper tone is secured. Hence, it is clear that the greatest care must be exercised, and the most thorough skill displayed.

The first operation, and the one upon which success depends, is the forming of the moulds. They are made according to plans which are first prepared to demonstrate the weight, thickness, and dimensions necessary to produce the required tone. The moulding is done entirely by hand, without the use of patterns. For the inside, the shape is made up of loam, which is merely sand mixed with enough clay to make it cohesive. With nothing but a trowel, a paddle, and his hands, the operator moulds the loam into the desired shape, working from the bottom toward the apex. The work is necessarily slow, as great care must be exercised, as any variation from the plans would inevitably ruin the effect, and frequent measurements are taken to see that there are no deviations. The surface is now covered with black lead. This is mixed into a thick paint, or mortar, and applied with a brush. Each coat must be allowed to dry, and successive coats applied until it reaches a thickness of about three-quarters of an inch, or until the desired shape is accurately secured. The outside half of the mould is built up of loam in the same way, only in this case no coating of plumbago is used. The exterior mould fits over the inside mould, the space between the two determining the thickness of the bell. The moulds being finished, they are placed in position in a pit in front of the furnace. At the apex, or at the point where the bell would be hung, an opening is made in the outside mould of about two inches in diameter. A trough then carries the molten metal directly into the mould.

The furnace is very similar to those generally used in melting large quantities of brass. The melting pot is built between two fire-boxes, so constructed that the heat strikes the sides and bottom with almost equal force, effecting quick results. The metal used is simply ingot copper and tin, in the proportion of four parts of the former to one of the latter. The copper is first melted, and then the tin is put into the molten mass, soon becoming a part of it. The kettle has a capacity of about a ton. For a bell weighing three hundred pounds, the mould is completely filled in seven or eight minutes. For bells weighing six hundred pounds, it requires about fifteen minutes, and so on.

The bell having cooled sufficiently, the moulds are broken, and it is taken out and turned over to the polisher. The inside, having been moulded against the smooth surface of black lead, needs no polishing, but the outside requires attention in that respect. The operation is very simple. The bell is hoisted to the center of a double revolving table. The part the bell rests upon revolves one way, the surrounding part in an opposite direction. This latter part is so constructed that it will hold a large quantity of coke. Thus, in revolving, the coke scours the outside of the bell, the result being a smooth, bright surface.

Before polishing, however, the tone of the bell is tested, and it is again tested after polishing, as carefully as the string of a piano or the reed of an organ. If satisfactory, nothing remains to do but the mounting.

An idea of the great accuracy that must be displayed in the plans and preparation of the moulds can be seen in that from ten to twenty-five pounds of metal, either too much or too little, in bells weighing from six hundred to two thousand pounds, or a variation of from one-twentieth to one-twelfth of an inch in thickness, will affect the tone. The successful manufacture of chimes and peals, therefore, can only be done by those whose knowledge of the business is as accurate as instinct, and this is possessed only by those who have followed the business for a lifetime.

What the Indians Have Cost Us.

The amount expended in Indian wars from 1776 to June 30, 1886, can at best be estimated. The several Indian wars after 1776, including the war of 1812 in the West and Northwest, the Creek, Black Hawk, and Seminole wars, up to 1860, were bloody and costly.

Except when engaged in war with Great Britain and Mexico, or during the rebellion (1860–1865), the United States army was almost entirely used for the Indian service, and stationed largely in the Indian country or along the frontier. It will be fair to estimate, taking out the years of foreign wars with England (1812–1815), $66,614,912.34, and with Mexico (1846–1848), $73,941,735.12, and the rebellion (1861–1865) and reconstruction (1865–1870), $3,374,359,360.02, that more than three-fourths of the total expense of the army is chargeable, directly or indirectly, to the Indians. (During our foreign wars, and the rebellion as well, many of the Indian tribes were at war with us, and others were a constant danger, a large force being necessary to hold them in subjection. Still, expense on this account is dropped from the estimate.)

The total army expense from March 4, 1789, to June 30, 1886, was $4,559,419,924. Deducting $3,514,911,007.48 for foreign wars and the rebellion, the remainder is $1,044,508,916,52.

Two-thirds of this sum, it is estimated, was expended for war and other services incidental to the Indians, viz., $696,339,277.68, fortifications, posts, etc., being deducted.

Total Cost of the Indians to the United States.

Indian department proper, from July 7, 1776, to June 30, 1886	$232,900,006.34
Expended by War department for Indian wars and incidental thereto from July 4, 1776, to June 30, 1886	696,339,277.68
Total	$929,239,284.02

Or almost a thousand million dollars.—*Smithsonian Report,* 1885, *Part II.*

AN India rubber horse shoe, consisting of a rubber bottom fitting over or around frog and hoof, with a projecting rim, is a recent invention for which important advantages are claimed.

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THE THORENBERG ELECTRIC PLANT.

Although the transmission of motive power, and the utilization of natural forces styled gratuitous, to a great distance, have not as yet been as extensively developed as some physicists had hoped that they would be, it must not be concluded from this that the question is forever lost. If we are to judge from their results, the most modest are also sometimes the most meritorious. From this point of view, the electric plant of Thorenberg, which we had an opportunity of visiting a few months ago, merits special mention, since it combines the (at present) most practical processes of utilizing natural motive forces at a distance. We believe it of interest to describe it.

Thorenberg is a point on the line from Lucerne to Berne, near the Litau station, about three miles distant from Lucerne. Here there is a waterfall 25 feet in height, derived from Emmen River. This fall, which already represents an important motive force, will become a greater one still when the work now in progress shall have carried the height of the fall to fifty feet.

Mr. Troller, owner of a steam flour mill located at three miles from the fall, conceived the happy idea of utilizing the latter and establishing there a genuine electric plant of a peculiar character. This plant, which is represented as a whole in Fig. 1, and of which Fig. 2 shows the interior arrangements, produces electric energy which is applied to two essentially distinct services, as well by the nature of the currents obtained as by the utilization of the same. To this effect, a turbine actuates a large shaft which extends along the entire length of the works, and runs two series of generators, viz.: (1) Alternating current generators, serving for the lighting of a part of the city of Lucerne; and (2) a continuous current machine, of which the current actuates, at a distance of three miles, an electric motor that runs Mr. Troller's mill.

We shall say but a few words concerning the lighting arrangement, reserving a detailed description of it for a special article. This service is performed with the aid of two Zipernowsky alternating current machines of 150 horse power, which supply a certain number of transformers distributed through Lucerne at the centers of the chief points of consumption. When running normally, each machine is capable of producing 1,800 volts at the terminals, and 40 amperes. The general principle of distribution by transformers on derived circuits has already been described here; so it is useless to revert to it. Let us merely recall the fact that the object of transformers is to reduce the high potential of conveyance to a feebler potential of distribution; and, consequently, one more easily utilized and presenting no danger. The transmission is aerial, and is formed of a double conductor consisting of two copper wires ¼ inch in diameter.

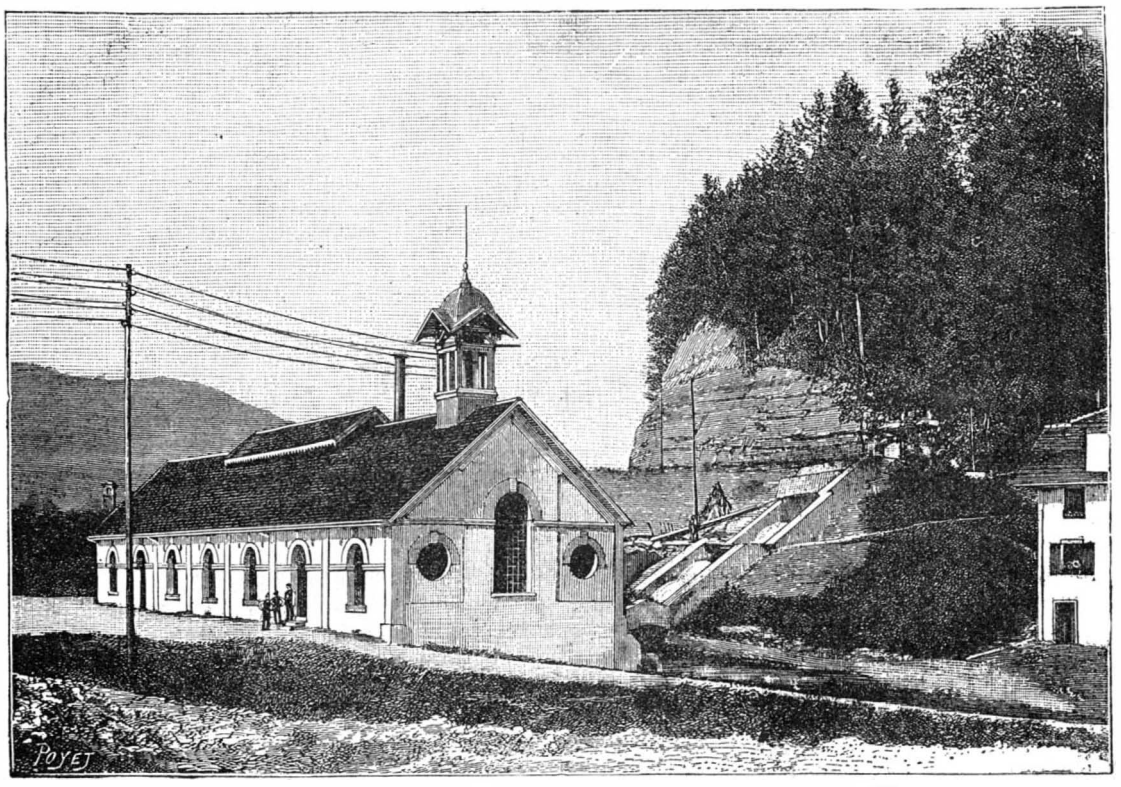

Fig. 1.—THE THORENBERG ELECTRIC PLANT.

The distribution at Lucerne presents the special character of a bouquet system; that is to say, all the lamps are distributed in quite a limited space, and at quite a great distance from the plant, the conductors from the latter constituting as it were the stem of the bouquet. It is a question, then, of keeping the potential constant, not at the terminals of the machine in the works, but toward the central point of bifurcation of the derivations that supply the transformers. The result is that the electromotive force of the generating machines must vary with the discharge, that is to say, with the number of lamps supplied at every instant, and be so much the greater in proportion as the discharge is greater, in order to compensate for the losses due to the resistance of the from five to six mile line. This result is obtained by means of an ingenious combination of compensators, whose principle we shall describe. The compensator is an apparatus designed, as its name indicates, to compensate by its operation for the effect of a detrimental action. It is a small transformer whose inductive circuit is mounted in the general circuit of the system of distribution, and is traversed by the total current of the machine, while the induced current is connected with the excitation of the machine. The excitation itself forms a special circuit, and is produced by one of the twenty induced bobbins of the machine, the nineteen others serving to produce the main current.

The excitation current is therefore due to the sum of the two electromotive forces that provoke it, one resulting from the rotation of the machine itself, fixed and constant for a given velocity, and the other derived from the transformer and variable with the discharge. It is unnecessary to say that the alternating excitation current is made continuous by a special commutator before reaching the movable inductors of the machine.

Under such conditions, the excitation, and consequently the electromotive power, of the machine increases automatically with the discharge by a purely physical regulation, without the intervention of any special mechanism. Resistances interposed in the excitation circuit permit, moreover, of putting the regulation in equilibrium according to the velocity adopted and to the variations that the latter may undergo.

The works themselves are lighted by fifteen lamps, supplied by a special transformer, but as this latter is branched at the start, nearly at the terminals of the machine, the lamps that it supplies would vary in luster with the discharge were not the variations com-

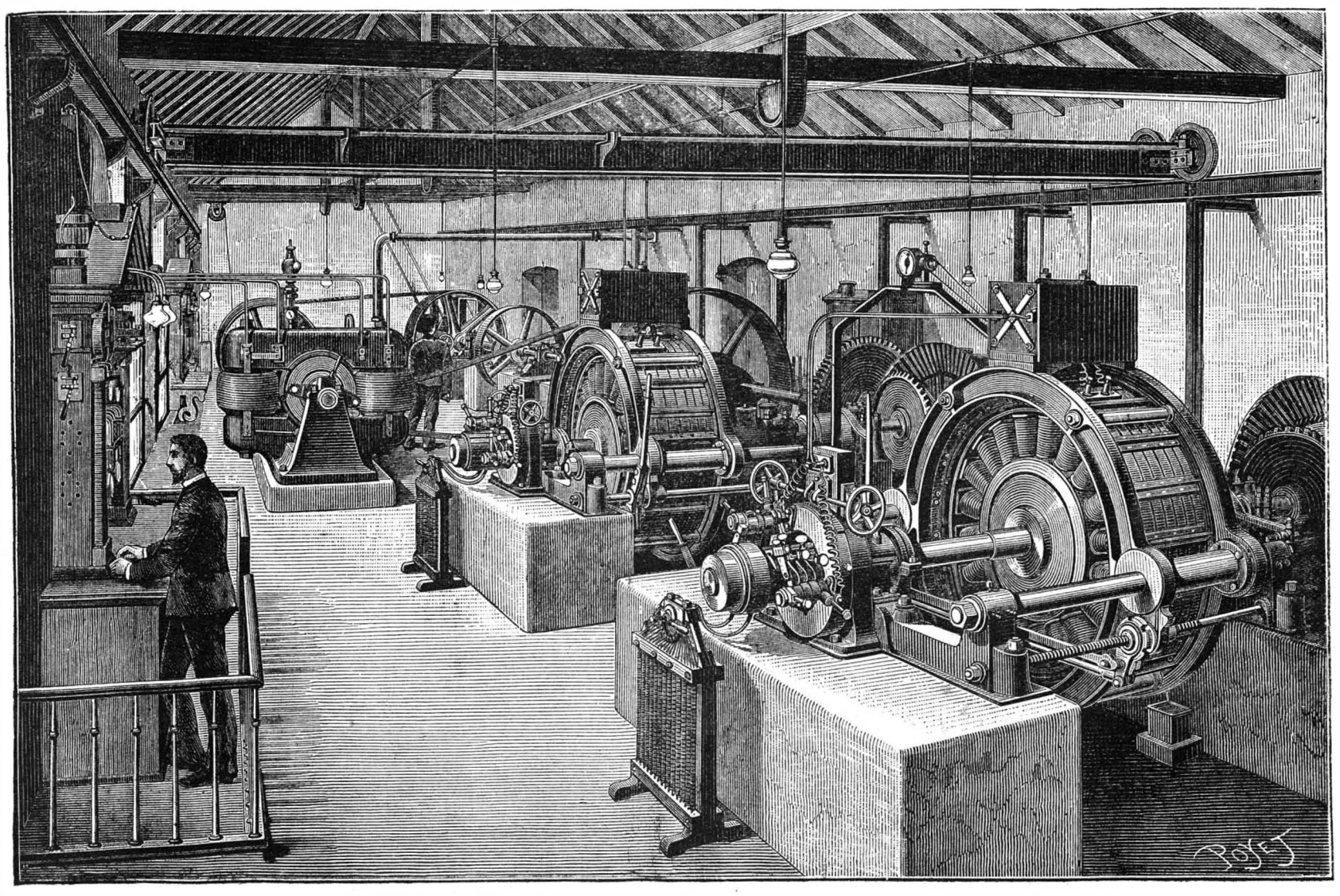

Fig. 2.—INTERIOR VIEW OF THE WORKS.

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pensated for by a special transformer. Finally, there are other transformers that serve to reduce the initial potential in a sufficient proportion to permit of the measurement of it by means of the apparatus in current use.

The Thorenberg installation is now supplying 3,500 Swan incandescent lamps of 10 candle power (35 watts), but, as all these are not lighted at the same time, a single machine suffices to perform the service. The light is paid for by contract, at the price of $4 per lamp per year.

The lighting has been done for nearly two years and a half, and has always given entire satisfaction.—*La Nature.*

Cedar for Paving.

The popularity of round block wood paving is steadily on the increase. A company has been formed at Mobile, Ala., with A. C. Danner, the well known lumberman, at its head, to put in machinery for making sapless blocks to pave the streets of that city, using juniper, cypress, and cedar. Cypress has been used more or less, juniper is said to be similar to the white cedar of the North, and the red cedar is thought to be better than the Northern white cedar. Wood paving can be put down at Mobile for $1.50 a yard, as compared with $3.50 to $3.75 for asphaltum.

Before it was decided to go into the paving business, extensive correspondence was had with residents of cities where wood paving is in use, the replies being uniformly favorable. Fred. A. Tromley, secretary of the Board of Public Works, Grand Rapids, Mich., wrote that for ten years the city had used only yellow cedar for wood pavements, and for the past few years only the sapless cedar blocks, the duration of the paving being from seven to ten years, also that wood pavements which are sprinkled during the summer last the longest. David P. Hadden, president of the Memphis, Tenn., taxing district, reported thirteen miles of cypress pavement in use. It was green, and of the Nicholson style, lasting ten or twelve years with good care. He advised putting down nothing but round blocks of red cedar. John Torrent, mayor of Muskegon, Mich., wrote that during the past two years about eighteen miles of cedar block paving had been laid in that city, its life being from ten to twelve years. He believes it the most practical wood paving of any now in use. H. R. Wagar, president of the Wagar Lumber Company, Ionia, Mich., said that the round cedar blocks had made an elegant, durable paving, especially where the traffic was light or moderate. R. R. Blacker, of the State Lumber Company, Manistee, Mich., considered cedar the best material to use for street paving, and said that its life depended upon the amount of traffic to which a street was subjected. E. J. Senseney, merchant, East St. Louis, Ill., favored wood paving, largely because it made no noise, and was free from dust, while asphaltum was very dusty, and, being impervious to water, caused shade trees to languish. For heavy traffic, he regarded granite the best.—*Lumberman.*

A GREAT STONE.

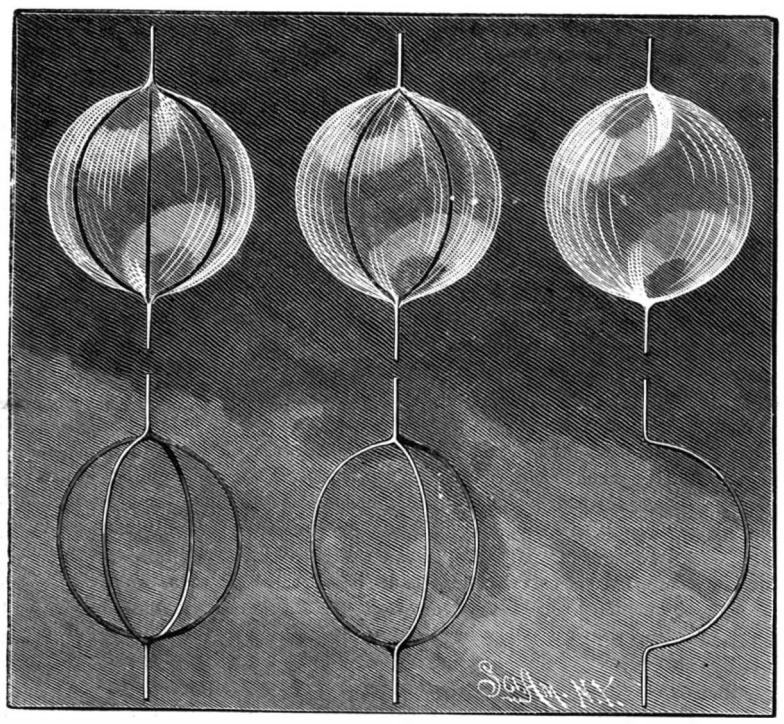
There was recently cut out from the Pilkington Quarry, Horwich, in one piece, without crack or flaw, a large stone, weighing upward of 35 tons. The dimensions are 14½ feet in length, 6 feet high, and 5 feet 3 inches wide. The removal of this mass from the quarry to its destination, a bleach works in Bolton, a distance of seven miles, over a rough, hilly road, was successfully accomplished, as shown above, by the Phœnix Steam Boiler Company, Bolton, under the direction of Mr. H. W. Rushton. The London *Engineer* remarks, it is said to be the largest stone ever quarried in England.

A GREAT STONE.

IT is a fact not well known that native sulphate of baryta is an active poison to rats, mice, and dogs. It is not easy to explain its action, considering its extreme insolubility, but mixed with lard it is readily eaten by them. This being the case, the question suggests itself, whether it might not replace the more dangerous poisons now so much used for this purpose, and do away with the risk attending them.—*Pharm. Jour.*

CURIOUS OPTICAL ILLUSION.

The engraving illustrates an interesting illusion observed by Mr. J. Rapieff, the well known electrician. The apparatus consists of semicircular and circular wire loops, provided with axles, by which they may be twirled between the thumbs and fingers. The lower row of figures shows some of the loops used in the experiment, while the upper figures represent the effects produced. The wire has a polished surface. When



CURIOUS OPTICAL ILLUSION.

the single semicircular loop is twirled, the only effect is to produce a gauzy glimmer of spherical form, as shown in the upper right hand figure. When three of the loops are joined together, each extending from the other at an angle of 120°, the figure produced is similar to that already described, but with two perfectly distinct curved black lines extending from one axle to the other, as shown in the upper central figure. When four loops are joined at right angles to each other, three jet black lines are shown, as indicated in the upper left hand figure. A circular loop shows a single black line.

This curious effect is produced by holding the apparatus so that the light is reflected as much as possible from the inner surface of the wire. The result is due to the eclipsing of the bright surface by the shaded portion of the upper loop as it passes between the eye and the lower loop. The whole of the loop is not eclipsed at the same instant, but persistence of vision causes the entire eclipse to be seen at once.

Success in this experiment depends upon holding the loops in the right position relative to the light, as well as the provision of the proper background. The loops should be held over a dark ground, with the axles parallel with the plane of vision. G. M. H.

WITHIN a radius of forty miles of Rochester there are more than 1,500 fruit evaporators, giving employment during the autumn and winter to about 30,000 hands. Last season the production of these evaporators was about 30,000,000 pounds, worth at first cost about $2,000,000. A large proportion of the product is exported.

Fecundity of the Eel.

Mr. Fred Mather, the well known fish culturist, has been estimating the number of eggs in a six-pound eel in November (in what is known to fishermen as "eel fat," but which are really the ovaries), and credits that eel with fully 9,000,000. Under the microscope he found that they measured 80 to the linear inch, and taking one ovary and dividing it by means of the most delicate scales known to science, he halved, quartered, and further divided the mass seventeen times, until he had a section small enough to count the eggs in it. This section represented 1-131,072 of the total number, and three sections were laboriously counted under the microscope. One of the sections contained 68 eggs, making the total 8,912,896 eggs. The second held 77 eggs, or 10,092,544 in the whole. The third section consisted of 71, from which it would appear that there were 9,306,112 eggs in the eel. Taking the last as the medium number, Mr. Mather figures, in round numbers, that that six-pound eel contained 9,000,000 eggs.

There have been many theories about the reproduction of the eel, some of them being wildly absurd, such as their being hatched by fresh water mussels, or that the lamprey was the female and the so-called silver eel the male, etc. The fact is that the lamprey, miscalled "lamper eel," is a form of life lower than that of the true fishes, to which the eel belongs, and is a vertebrate with a cartilagenous skeleton instead of a bony one, has its skull imperfectly developed, and has no lower jaw. Superficially it appears like an eel, but is not nearly related to it.—*N. Y. Sun.*

Cleaning Furs.

Now that the season has arrived for getting out fur garments, some of our readers will doubtless be glad to hear how such garments are cleaned and renovated in Russia, the country of furs.

Some rye flour is put into a pot and heated upon a stove, with constant stirring as long as the hand can bear the heat. The flour is then spread over the fur and rubbed into it. After this, the fur is brushed with a very clean brush, or, better, is gently beaten until all the flour is removed. The fur thus resumes its natural luster and appears absolutely as if new.—*La Science Illustre.*

Transmutation of Cotton Seed.

Was there ever, says *Banker's Monthly*, such a history as that of the cotton seed? For seventy years despised as a nuisance, and burned or dumped as garbage, then discovered to be the very food for which the soil was hungering, and reluctantly admitted to the rank of utilities, shortly afterward found to be nutritious food for beast as well as for soil, and thereupon treated with something like respect. Once admitted to the circle of farm industries, it was found to hold thirty-five gallons of pure oil to the ton, worth in its crude state $14 to the ton, or $40,000,000 for the whole crop of seed. But then a system was devised for refining the oil up to a value of $1 a gallon, and the frugal Italians placed a cask of it at the root of every olive tree and then defied the Borean breath of the Alps. And then experience showed that the ton of cotton seed was a better fertilizer and a better stock when robbed of its thirty-five gallons of oil than before, and that the hulls of the seed made the best of fuel for feeding the oil mill engine, and that the ashes of the hulls scooped from the engine's draught had the highest commercial value as potash, and that the "refuse" of the whole made the best and purest soap stock, to carry to the toilet the perfumes of Lubin or Colgate.

Sure Death to Buffalo Moths.

Of the vast number of remedies tried for exterminating that most troublesome pest, the buffalo moth, the following is said to accomplish the object:

Take strips of red or blue flannel (as these colors are particularly attractive to them), dip in liquid arsenic, and lay around the edges of carpets, or wherever the pests are troublesome. They will soon eat a desired amount and collapse, to the entire satisfaction of the housewife, without the least injury to her carpets.

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The Re Umberto—the New Italian Warship.

The Re Umberto, recently launched at Castellamare, Italy, in the presence of the Emperor William and King Humbert, is a steel twin-screw, deck-protected, barbette ship of 13,298 tons displacement. The Re Umberto is nearly as large as the Italia, which was launched also at Castellamare in 1880, and the Lepanto, which was launched at Leghorn in 1882. As far as beam alone is concerned, she is bigger than either of those leviathans; and in this respect there is nothing afloat that can rival her. Her dimensions are: Length, 400 ft. 4 in.; breadth, 76 ft. 9 in.; and her mean draught of water with all her weights on board is expected to be 28 ft. 8 in. She has no side armor at the water line. A large amount of protection is, however, afforded to her by the construction of her bottom and sides, by the subdivision of her hull into a great number of water-tight compartments, and by a curved steel deck near the water line. The ship's bottom is composed of three skins, which form two water-tight spaces that are further subdivided transversely. Experiments to test this mode of construction were made several years ago in Spezia harbor. A caisson, built up in a similar way, was moored, and a charge of 75 lb. of guncotton was exploded in contact with it, and at a suitable depth. The two outer skins were ruptured, but the inner skin remained intact. Subsequently the inner one of the two spaces was filled with coal, and the experience was repeated. This time only the outer skin was shattered. It may therefore be taken as proved that the construction of the Re Umberto affords protection against a considerable torpedo charge. The armored deck leaves the ship's side 6 ft. below the water line, and curves upward, until, along the middle line of the ship, it is but 2 ft. below the water line. It is formed by a ⅝ in. steel plate, overlaid by a 2⅝ in. compound plate. Below this deck and between it and the ship's bottom there are over fifty water-tight compartments. Between the armored deck and the deck immediately above it there are one hundred other water-tight compartments. If, therefore, water were to enter the ship either above or below the protective deck, its volume and evil effects might, with proper precaution, be strictly limited. The chief part of the armament will be carried in two barbettes, one forward and the other aft, on the middle line of the vessel. Each of these barbettes will be plated with compound armor 19 in. in thickness, placed at an angle of 24 deg. from the vertical. The ammunition hoists between the amored deck and the barbettes will also be armored, and the bases of the funnels will have substantial protection to a height of over 3 ft. above the water-line. Beyond this the vessel will have no armor.

The engines have been built by Messrs. Maudslay, Sons & Field, London. They are of the compound type, and are splendid specimens of marine engines, but it must be remembered that they were designed as far back as 1884. The following are the leading particulars of the engines of the Re Umberto, viz.: Four sets of compound engines, two sets being applied to work each screw propeller, each set having one high-pressure cylinder 47 in. diameter and one low-pressure cylinder 89 in. diameter, with a stroke of 4 ft. 3 in., making about 100 revolutions per minute. Diameter of screw propellers, 20 ft. Eighteen main boilers, 14 ft. 3 in. diameter, 9 ft. 6 in. long, having altogether seventy-two furnaces, 3 ft. 2 in. diameter, 6 ft. 4 in. long, with an aggregate area of grate surface of 1,444 square feet, and a total heating surface of 40,230 square feet. The working pressure of the steam is 100 lb., and the indicated horse power, 19,500. It is expected that these engines will drive the ship at an extreme speed of 18 knots. The coal capacity of the vessel is 1,200 tons.

The armament of the Re Umberto, in addition to a ram, will comprise four 17 in. new model 104 ton Armstrong breech-loaders, two being mounted in each barbette; twelve 6·1 in. Armstrong 4½ ton breech-loaders, carried in the batteries; six 3 in. guns and ten machine and quick-firing guns, together with torpedoes. The so-called 104 ton gun—that is not its exact weight—has a total length of 40 ft. 9 in., the length of the rifled bore being 28 ft. 10⅜ in., and of the powder chamber 7 ft. 6 in. The number of grooves in the rifling is eighty, and they have a twist of 1 in 50 calibers, or, in other words, of one revolution in 70 ft. 10 in. The full firing charge for the armor-piercing projectile is 900 lb. of progressive Fossano powder; for common shell it is 600 lb. The projectiles weigh 2,000 lb. each. The bursting charge of the armor-piercing projectile is 32 lb.; of the common shell, 60 lb.; and of the shrapnel, 5 lb. The muzzle velocity of the gun, when fired with the full charge, is 1,992 ft. per second. The muzzle energy is 55,030 foot-tons—sufficient to raise the Re Umberto, guns and all, more than four feet out of the water; and the projectile, at the muzzle of the gun, is capable of perforating 33½ in. of wrought iron. These heavy guns will be carried at a height of 28 ft. above the surface of the water.

The Re Umberto is to be completed for sea in 1892. Her design, which is also that of her sister ships, the Sicilia and the Sardegna, and of her kindred, the Italia and the Lepanto, has excited much criticism; and many competent judges have not hesitated to express an opinion that in the line of battle a vessel of this description would be dangerously out of place. Yet, if the Re Umberto is not useful as a battle ship, it is hard to see what she can be useful for. The *Times* says that, writing in the August number of the *Jahrbucher fur die deutsche Armee und Marine*, Herr Spiridion Gopcevic denies her utility altogether. She is, he declares, neither a battle ship nor a cruiser. She is not a battle ship for the reason that her sides are entirely unarmored. She is not a cruiser for the reason that she does not carry sufficient coal. She is, moreover, too costly to be risked on cruiser's work. For the cost of a single Italia or Re Umberto, four iron-clads, each of about 3,500 tons, might, he thinks, be built. Their united strength in artillery might equal that of the big ship; and if that were so, they would, he maintains, be together much more than a match for the monster. There would be four vessels—that is, four rams against one; and it is hard to believe that, even if she were successful in one or two cases, the large vessel would put out of action or sink all her opponents before being herself sunk. Nay, more, the single ship, in this comparison, labors under the considerable disadvantages of being unable to divide herself and to be in four places at once. She is the less able, therefore, to enforce a blockade. Her draught of water debars her from many ports and waters, her size from many docks. She takes four times as long as a small vessel to build. Whenever she is under repair, a fourfold strength is doomed to lie idle. Herr Gopcevic urges all this, and much more, against huge unarmored ships; and doubtless Italy has run some risk in investing so much money in them as she has invested during the last twelve years. Her navy is not, and never can be, strong enough to theoretically justify her in putting more than comparatively few eggs into one basket. Nevertheless, the Re Umberto, for offensive purposes at least, deserves to be called a most formidable ship, if only because she will, when completed, throw a heavier weight of shot than any ship that has yet been built. Including all guns of 6 in. caliber and over, the gun-strength of the most heavily armed battle ships of the naval powers is as follows:

	Weight of Discharge.	Muzzle energy of Discharge.
Re Umberto (Italian)	8,960 lb.	236,896 foot-tons.
Amiral Baudin (French)	5,950 "	124,770 "
Victoria (British)	5,176 "	132,632 "
Deutschland (German)	3,864 "	66,530 "
Tchesme (Russian)	4,988 "	123,772 "
Krp. Rudolf (Austrian)	3,000 "	57,000 "

This comparison, even if no other elements be taken, is sufficient to show that, whatever may be the weaknesses and demerits of the Re Umberto, she is a very dangerous adversary and a very remarkable ship.—*The Engineer.*

Puget Sound Lumber.

Lumber is the oldest, most profitable, and the most actively prosecuted industry of the sound, employing as it does a capital of over $60,000,000 and thousands of men. Six or eight combined and wealthy sawmill companies virtually control it, owning their own timber lands, ships, stores, and the town sites upon which their mills are located, the dwellings of which are simply rented to their employes. They govern not only the price of the manufactured article, but the amount that shall be manufactured and the price that shall be paid loggers for logs. These are mainly of red fir, the trees often attaining a height of over two hundred and a diameter of eight to ten feet, single logs frequently yielding over 16,000 feet of manufactured lumber.

Logs are usually cut in the spring and summer, as convenient to streams as possible, to which they are hauled by long strings of oxen over well-greased round timbers, laid every eight feet, called skids, floated to the sound, made up into rafts and towed to one end of a long sawmill, usually located on some convenient harbor. Here they are scaled and bought by the mill company at from four to six dollars per thousand feet, according to quality. At the opposite end of the mill, anchored stern on, are vessels from Californian, Australian, and other ports, awaiting their cargoes. So complete are the modern sawmill devices for the manipulation of these enormous logs, that the hand is seldom touched to them till the manufactured article is pushed into the stern portholes of the vessels for stowage. One must be on the alert in order to follow the log when jerked from the water up an incline to the mill platform, squared by circular saws, its slabs cut into lath pickets and other small stuff, and the remainder quickly reduced by gang, band, circular, and other saws to timber, joist, plank, and boards, and delivered to the awaiting ships.

Some of the large mills have a daily output of 200,000 feet, and outward bound cargoes of from 800,000 to 1,200,000 are not unusual. The refuse pieces are carried on an endless belt of iron links, running in a trough to a safe distance from the mill, and to a pile that is constantly burning, to which pile is also blown, through a long capacious iron pipe, the sawdust. In this way scraps that, at the East, would be worth hundreds of dollars annually, but that here would soon prove a serious and costly obstruction, are removed and destroyed automatically.

As the sawmill companies own their own vessels, pay about five dollars per thousand feet for logs, and receive from $18 to $25 per thousand feet for the manufactured lumber at San Francisco, hauling back on their return trips, at little or no cost for freight, merchandise of all kinds to be retailed out to their men at large profits, the business necessarily proves a bonanza of the richest kind.

The Heroult Aluminum Process.

The Swiss Metallurgical Company, established close to the Rhine Fall at Neuhausen, has adopted the process of M. Heroult for the production of alloys of aluminum. The process resembles in some ways that of the Cowles Brothers, which is so successfully employed at Lockport in the United States, and which has been recently introduced in England and the Continent. In both the Cowles and Heroult processes an electric current is employed. In the former it is used simply to produce a very high temperature in a limited zone, the reduction of the ore being due to the temperature alone, and not to any effect of electrolysis, so that an alternating could be used as well as a continuous current. In the Heroult process, according to the views of the inventor, the reduction of the ore is partly electrolytic and partly due to the heat of the arc. The furnace has a carbon pole at the top, and the current passes in by it through the melted aluminum oxide to the reduced metal at the bottom, the ore is decomposed, the oxygen passing upward and attacking the carbon, while the molecules of the metal travel downward and are merged in the metal bath.

The furnace used in the process is a large carbon block hollowed out in the proper shape and inclosed by a frame of iron. In the smaller furnaces a single block of carbon is used, and the iron is cast around it; for larger sizes slabs of carbon are used, and are held together by wrought iron bands. There is an opening in the bottom of the furnace for drawing off the reduced metal. The current enters the crucible through a carbon electrode which enters the top, and which consists of a bundle of carbon slabs ten feet long, seventeen inches wide, and nine and a half inches deep. The distance of this electrode from the surface of the molten metal is regulated by an attendant. This distance is very small, preferably not over a quarter of an inch. One of the electrodes is consumed in producing about half a ton of aluminum. The crucible is covered by carbon slabs insulated from the body of the crucible. In the top holes are provided for the introduction of ore and scrap metal. The ore generally used is alumina, free from silicon and other impurities, and the scrap metal is either iron or copper, according to the alloy which is desired. The process of smelting is a continuous one, the ore being introduced and the crucible tapped at regular intervals. The production of aluminum per horse power hour varies somewhat with the percentage of the metal contained in the alloy, the average being thirty grammes of aluminum and the maximum being forty grammes. That is, to produce one pound of aluminum requires fifteen horse power hours on the average, and eleven horse power hours under favorable conditions. The present capacity of the crucible is four hundredweight of aluminum in twenty-four hours.

At the works at Neuhausen the current is produced by two dynamos driven by a turbine of three hundred horse power. These dynamos are of the multipolar type, designed by Mr. C. E. L. Brown, and built at the Oerlikon Engineering Works. They are designed to give six thousand amperes each, at an electromotive force of twenty volts, and they can be worked up to thirty-five volts. The speed of the turbine is controlled by an automatic regulator acting upon a throttle in the inlet pipe of the turbine. While the working current is normally twelve thousand amperes, it sometimes increases to twenty thousand amperes, because of a short circuit in the furnace, caused usually by one of the slabs of which the carbon electrode is made burning more slowly than the others and touching the surface of the molten metal. This increase of current does not injuriously affect the dynamos. There is no sparking at the brushes of the dynamos. The process promises to be a successful one. From the figures given it compares favorably with the Cowles process in the amount of aluminum reduced per horse power.—*Science.*

An Antiseptic Gargle.

The *Union Medicale* credits Muller with the following formula:

Thymol	3½ grains.
Benzoic acid	45 "
Tincture of eucalyptus	180 "
Water	11,250 "

At bedtime the teeth are to be cleaned with powdered soap and a brush, and then the mouth can be rapidly sterilized by gargling for half a minute or a minute with the solution.—*New York Medical Journal.*

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ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Alfred R. Heath, of Covington, Ind. This invention covers novel connections for car couplers, so constructed and arranged that the coupling will be effected automatically, and the uncoupling may be made from either side or top, or from the cab of the locomotive.

A car coupling has been patented by Mr. John H. Davis, of Wilmington, N. C. The drawbar is made with two jaws having a vertical opening, one of the jaws having a vertically pivoted and horizontally swinging knuckle, on one side of which is a hook and on the other side a locking arm that drops behind a spring-seated tongue to lock the hook in rigid coupled position.

MISCELLANEOUS INVENTIONS.

A gate has been patented by Mr. Isaac Dutton, of Harbor Springs, Mich. This invention covers a novel construction of gate, which may be hung to swing in both directions, which may be tilted, and which will be self-closing.

An insect powder duster has been patented by Robert E. Clark and Jessie L. Zeigler, of Fort Motte, S. C. This invention covers an apparatus which may be attached to any wheeled vehicle or used alone, as desired, for distributing poison over plants.

A clothes drier has been patented by Mr. Van Rensselaer Ten Broeck, of Jersey City, N. J. All the principal parts are made of wood, the arms being readily raised and lowered, and when not in use the arms may be all removed, and the device placed away in small space.

A trace bearer has been patented by Mr. James H. Brennan, of Shullsburg, Wis. This invention covers an improved construction, whereby the lower end of the round trace-bearing loop is strengthened and re-enforced, and its connection with the supporting strap or skirt rendered more secure.

A combined punching and shearing machine has been patented by Mr. Henry A. Ridley, of Newport, Ark. It has a head mounted to slide by the action of a lever operating the punch and shear, to facilitate the cutting and punching of metal plates, such as boiler iron, etc.

A shoe lace fastener has been patented by Mr. John G. Hart, of New York City. It consists of a head having a concave under surface and provided with a central shank having shoulders and prongs, making a simple and effective device for fastening the end of a shoe lace.

A finger ring has been patented by Mr. John B. Newman, of Milford, Pa. It consists of an inner ring with pictures or ornaments on its face, and a second ring held movably on the face of the first ring, with a transparent cover which permits of viewing one of the pictures at a time.

A cracker box cover has been patented by Messrs. Albert H. Pine and Stephen A. Norton, of Pine Bluff, Ark. It is designed to exclude flies and prevent the drying out of the contents, while still permitting the crackers to be visible from the outside, and to be conveniently removed as they are sold.

A wash boiler has been patented by Mr. Monroe Davis, of Oak Valley, Kansas. It has a removable interior wire framework of a base and cones detachably and adjustably connected, to support the clothes in such manner that the steam may reach every part, and the material will be extended.

A sled brake has been patented by Mr. Hans C. Johnson, of Rhinelander, Wis. It consists of dogs pivoted to the runners and connected with diagonal rods connected to a lever pivoted to the pole, whereby the lower ends of the dogs may be forced into the snow, or readily held up out of the way.

A filter has been patented by Messrs. Emil Fretz and Jacob Waespi, of Dallas, Texas. This invention covers an improvement on a former patented invention of the same inventors, making a filter of simple and durable construction, which can be easily and conveniently cleaned without disturbing the gravel.

A hoisting machine has been patented by Messrs. Alexander and James Robertson, of Welland, Ontario, Canada. This invention covers a novel construction and combination of parts to improve the construction of hoisting machines, so that greater working capacity may be obtained therefrom.

A piano pedal has been patented by Mr. Otto Lestina, of Derby, Conn. It is made with an elastic metallic strip secured to and projecting from its rear end, the pedal not being pivoted, and designed to avoid squeaking and the wear of parts, the elastic plate serving as a spring.

A gate has been patented by Mr. Thomas Tyson, of Mound City, Mo. Its construction is such that it may be adjusted vertically to clear obstructions, as of snow or ice, in connection with a novel arrangement of the latch, and various other details of construction and combinations of parts.

An oil distributer for ships has been patented by Mr. John Ericson, of Sabine Pass, La. This invention covers a novel construction of vessel to be launched upon the sea when the water is rough, to distribute oil thereon in such quantities as may be predetermined, and which can be readily regulated.

A gate has been patented by Mr. John H. Bradford, of Lebanon, Ky. Combined with a horizontally swinging gate and its pivot post are side posts carrying levers, with swinging handles, by pulling on which, through a novel arrangement of lever connections, the gate may be opened from either side.

A sash holder has been patented by Mr. Joseph Clough, of Pawtucket, R. I. This invention covers an improvement in window fasteners, consisting of two pivoted cams simultaneously thrown out of action, or out of contact with the window sash, by means of a pivoted lever, which is connected with both cams.

A machine for winding sewing machine bobbins has been patented by Mr. George Hogg, of Newburg, N. Y. This invention covers a novel construction and arrangement of parts, in a machine in which the bobbins are placed on spindles, the thread being broken as one bobbin is filled, when another bobbin is brought into position.

A hame tug has been patented by Mr. Wallace Boardman, of Harrisonville, Mo. It is made partly of leather and partly of metal, and designed to save leather, being so made that the front or rear part, if broken, may be removed without throwing the other away, or one section can be replaced without opening the whole tug.

A method of making button hole strips has been patented by Messrs. Edward K. Warren and Joseph H. Ames, of Three Oaks, Mich. It consists in making a series of button holes from the same piece of goods, whereby a strip or sheet of ready made button holes suitable for garments of various kinds is produced, to form finished edge button holes.

A creamer has been patented by Mr. Ernst H. Wilke, of Lincoln, Neb. This invention covers a novel construction and combination of parts, including a number of receptacles in which the cream is caused to rise quickly and can be conveniently stored, and in which the butter made from the cream can also be stored, both retaining their qualities and flavor.

An apparatus for varnishing wheels has been patented by Mr. Ernest W. Gerbracht, of Brooklyn, N. Y. It consists of a tank in which the wheels, placed on a spindle, are allowed to remain in a varnish bath, and another similar tank in which the spindle may be revolved, with its wheels, to remove superfluous varnish.

A button fastening machine has been patented by Mr. August Schillmoller, of San Francisco, Cal. It has pivoted arms, on one of which an anvil and button receptacle are supported, a movable button holder being carried on the other arm, with various other novel features, making an improved machine for fastening buttons on shoes, gaiters, etc.

A paper file has been patented by Mr. Augustus C. A. Perkes, of Portland, Oregon. The invention consists of two wire frames hinged together and pressed one on top of the other by a spring, with pins or spikes held on the under frame and adapted to be passed through the paper to be filed between the two frames.

A cant hook has been patented by Mr. Milton N. Rankins, of Willettsville, Ohio. The hook proper is double pivoted, and there are various other novel features of construction, whereby a firm hold, free from slip, is secured upon a log or body to be rolled or turned, obtaining a powerful action for the cant hook.

A flour or meal bin has been patented by Mr. Charles W. Fishel, of Fair Play, Col. Its construction is such that the flour may be sifted as drawn from the bin, and its opened door will constitute a bread board, the bin to be made of convenient size for ordinary household use, and its form permitting of its being readily cleaned.

A baling press has been patented by Mr. Potivent I. Crews, of Meridian, Miss. This invention covers novel features of construction and combinations of parts designed to form a simple and easy working press for baling cotton, hay, straw, etc., and which may be operated to form good bales with economy of time and labor.

A vehicle wheel has been patented by Messrs. Henry M. Rice and John O'Day, of Allegheny, Pa. Its construction is such that any of the spokes may be readily removed for renewal or repairs without disturbing the felly or tire, while automatic lubrication of the axle bearings is provided for, and the wheel is made very strong and light.

An exhibitor for shirts, etc., has been patented by Messrs. George H. Hardy and Rollin A. Baldwin, of Manchester, N. H. This invention covers a novel construction of frame or exhibiting stand, having a simple and neat appearance, adapted to support shirts, collars, cuffs, etc., and exhibit them to the best advantage.

A bitters or medicinal compound has been patented by Messrs. Camillus E. and Ernest Bizzozero, of West Quincy, Mass. It is made with alcohol, centaury, yarrow, angelica, calamus, cinnamon, myrrh, aloes, vanilla, cloves, nutmeg, and camphor, in certain proportions, for use for bowel troubles, neuralgia, headaches, fever, etc.

A running gear for vehicles has been patented by Mr. George E. Crutchfield, of English, Ark. It is made of metal, with tubular axles, a tubular reach, and tubular forward and rear hounds, the forward hounds turning with the pole and acting as a fifth wheel, and the construction being simple, durable, and economical.

A pneumatic door opener has been patented by Mr. William R. Ostrander, of New York City. This invention is designed to provide simple and effective means for releasing the bolt of a door lock from the plate in the door jamb, and to impart force for producing the result from a part of the building more or less remote.

A spring bed bottom has been patented by Mr. Edwin F. Tilley, of Brooklyn, N. Y. A fabric is stretched over a main frame, with central re-enforcing springs for the fabric, a re-enforcing frame supported by the springs and underlying the central opposite edge portions of the fabric, the structure being designed to be inexpensive, durable, and comfortable.

A shaft tug has been patented by Mr. William Snow, of Waverly, Ill. This invention provides a strap which will be always open to receive the shaft, and ready to tighten down upon it, while it is designed to hold securely under any tension exerted to force it from the proper position, without the aid of extra straps attached to the belly band.

A fence has been patented by Messrs. James Higgins and John Sullivan, of Grand Rapids, Mich. The post is made with a longitudinal rib having open slots for receiving the fence wires and the top guard rail, the design being to afford a structure which can be easily and quickly set up by unskilled labor, and will be firmly braced and stayed.

A bed has been patented by Mr. Samuel R. Millen, of Clarinda, Iowa. This invention covers an improved construction of beds for invalids, in which, by turning a shaft, the back section will be raised and the foot section lowered, to bring the occupant to a sitting position, while, by reversing the shaft, the bed is returned to normal position.

A device for hitching horses has been patented by Mr. Edmund H. Turner, of Fergus Falls, Minn. It consists of a ring piece with a slot and toothed flange, with a fastening device of cross piece and spikes, being especially adapted to be secured to a crack in planking, such as a board fence or sidewalk, in which the device will be firmly and securely held.

A thill holder has also been patented by the same inventor. A loop is attached to the inner surface of the dash board, from which a strap is swung over the dash board having hooks to engage a cross piece of the thills, the latter being partially supported by a spring, which throws up the thills when released, so that they may be held up by the strap.

A drag saw has been patented by Messrs. John Winger and John W. Barger, of Harrison, Ark. This invention covers a novel construction and combination of parts in a machine that will have a force feed, and wherein various styles of toothed saws may be used, and wherein also the power may be readily and conveniently regulated according to the work to be done.

A shutter worker has been patented by Mr. James K. McGukin, of Newark, N. J. Combined with an outer tube or casing is an inner concentric tube having a spiral bore, a radial arm being attached to the inner tube, with other novel features, whereby a shutter may be held partially or entirely open, and conveniently operated from the room with the windows closed.

A grain measuring, registering, and bagging machine has been patented by Mr. George R. Kendrick, of Bucyrus, Ohio. This invention covers an improvement on a former patented invention of the same inventor, of a machine in which the grain delivered from the separator of the thrashing machine is measured, registered, and delivered in any desired quantity to the bags.

A truss frame for ladders has been patented by Mr. Caleb C. Pierson, of Elizabeth, N. J. This invention covers a novel construction and combination of parts whereby ladders may be conveniently and safely used for scaffolds, making a safe and stiff scaffold of any length from 6½ feet up to 42 feet, by adding 6½ foot sections, the material being just as useful for any length of ladder as for scaffolds.

A fence for intercepting insects has been patented by Mr. Emil C. Krause, of Stockbridge, Wis. It is made with boards jointed together at their ends, with a tarred rope at their upper edge, and an outwardly extending board made to form a channel, whereby bugs will be prevented from passing from one field to another, and will be received in a receptacle where they can be destroyed.

The manufacture of starch forms the subject of a patent issued to Mr. Hermann Wiegand, of Danville, Ill. This invention covers a process of mixing or incorporating with the liquid starch a volatile hydrocarbon, such as refined coal oil, then moulding and finally drying the starch, the hydrocarbon being eliminated by the drying process, thus making starch which will not ferment while wet or discolor in drying.

A saw filing machine has been patented by Mr. William J. Lindsay, of Ottumwa, Iowa. It has a mechanism for reciprocating a file and moving it away from the tooth in one direction of its movement, with a mechanism for simultaneously unclamping and conveying the saw forward, and then clamping it, by which no injury can be done to the saw or file, and every tooth will be cut to the same depth.

An oat extractor for grain separators has been patented by Mr. William P. Clifford, of Ottumwa, Iowa. A hopper projects into a casing having an inclined apron and screen, an oat-extracting cylinder attached to a shaft being placed opposite the discharge opening of the hopper, while a brush is fitted to work as closely as desired to the surface of the extracting cylinder.

A harness has been patented by Mr. Cyrus C. Cole, of Albion, Mich. This invention covers improved means for coupling traces to breast collars or to tug attachments of hame collars, the coupling device consisting of a sleeve or frame adapted to receive and slide upon a trace, and having a lever or tongue for engaging the latter, with a lateral hook for engagement with the harness collar.

A machine for coating fabrics has been patented by Mr. Henry G. Bunch, of Rahway, N. J. The fabric is carried by a roller having brakes to prevent its turning too freely, thence under and over cross pieces, one acting as a tentering bar, thence under an adjustable spreader, and through a drawing roller and beater, to distribute various kinds of coating material evenly over a fabric.

Driving reins form the subject of a patent issued to Mr. Matthew S. Dickinson, of Ridgely, Md. This invention covers a novel use of overdraw bits, overdraw straps, and short side rein sections, to dispense with the ordinary check rein, causing the horse to carry a high head, but allowing freedom to stretch out his neck and lower his head when tension on the rein is slackened.

A machine for grooming horses has been patented by Messrs. William Dellinger and John G. McNaughton, of Marion, N. C. It has alternating rotary combined brushes and combs and stationary combs, each of the latter consisting of a continuous plate bent or folded upon itself, and having divergent side plates provided with toothed lower longitudinal edges.

A flywheel has been patented by Messrs. J. A. Romano and E. A. Barton, of Celayo, Guanajuato, Mexico. This invention covers a fast and loose attachment for sewing machines by which the flywheel may be revolved with the shaft in one direction and independently of it in a contrary direction, or the flywheel may be disconnected from the driving shaft to turn independently in either direction.

A composition for developing ozonized oxygen has been patented by Mr. John E. P. Meyer, of Golden, Col. The onstituent parts of the compound are barium permanganate and the acid salts of sulphuric acid in powdered form, to be used in proportions specified in connection with water, forming a ready, safe, and simple means of producing ozonized oxygen in sick rooms.

A curtain or lambrequin support for windows has been patented by Messrs. Charles C. Bauer and Frank H. Frankenberg, of Pueblo, Col. It is made with bars having bearings at their upper ends for the curtain or lambrequin rods combined with links pivoted thereto and adapted to be connected with the upper sash, the curtain or lambrequin being moved away from the opening when the upper sash is lowered.

An apparatus for reproducing copies of writings, drawings, etc., has been patented by Mr. Gustav H. Block, of Penge, Surrey County, England. It is of that class in which a lithographic stone or zinc plate is written or drawn on, and a negative impression taken on a sheet of gelatinous composition, making the printing surface from which impressions are transferred on to paper, the invention providing a portable apparatus which can be employed by an unskilled person.

A spring bed bottom has been patented by Mr. Frank C. Rheubottom, of Union City, Mich. It consists of slats adjustably secured together, coiled springs secured to the slats having their upper ends passed under and around the upper coil of the spring on the adjacent slat and then loosely connected to the spring on the same slat, the springs thus accommodating themselves to the lateral adjustment of the slats, while being connected securely lengthwise, and always forming a continuous bearing surface.

Mosaic wood work and a method of making it form the subject of two patents issued to Mr. William J. Kelley, of Pittsfield, Mass. It is a form of mosaic flooring or wainscoting made in composite strips which are arranged side by side upon the floor base or wall to delineate the desired pattern. Thin, slightly flexible sheets of soft wood are made the base, upon which are glued a series of vari-colored hardwood facing strips, the grain of successive strips being alternately crosswise of and in the direction of their length, and the whole is then sawed through on lines transverse to the length of the facing strips, making strips having a single succession of vari-colored square facing blocks. These strips are then grooved on their side edges, whereby they may be connected by longitudinal splines and conveniently fixed in position on the floor, the facing blocks being free to expand and contract in either direction.

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solicit correspondence relative to manufacturing specialties requiring malleable gray iron, brass, or steel castings.

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Lockwood's Dictionary of Terms used in the practice of Mechanical Engineering, embracing those current in the drawing office, pattern shop, foundry, fitting, turning, smith's and boiler shop, etc., comprising over 6,000 definitions. Edited by a foreman patternmaker. 1888. Price, $3.00. For sale by Munn & Co., 361 Broadway, New York.

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SCIENTIFIC AMERICAN
BUILDING EDITION.

NOVEMBER NUMBER.—(No. 37.)

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. A. asks for a receipt how to make waterproof writing ink, an ink which will not blur if the writing is exposed to rain. A. Dissolve 2 ounces shellac in 1 pint alcohol (95 per cent), filter through chalk, and mix with best lampblack.

(2) D. H. A. asks: What is the best known substance or preparation that will waterproof canvas and make it mildewproof and proof against rot? What is the best known waterproof cement for canvas, that will make sewed seams in canvas waterproof? A. We recommend paraffine applied to the perfectly dry tissue and melted in with a hot sadiron, for both purposes, or 1 pint linseed oil and 1 ounce beeswax may be mixed and applied with a brush and allowed to dry before use.

(3) C. S.—Any conductor, carbon or metal, is heated by the electric current. Lime is a non-conductor and will not be heated.

(4) W. B. asks what ingredients to use in dissolving gum shellac in water. A. Borax.

(5) W. W. W. seeks information as to the best methods of making magic lantern slides from dry plate negatives. By what is known as the "wet plate process" very good slides are easily made, but it is somewhat messy and is productive of blackened fingers. The glass plate, after being thoroughly cleaned, is coated with collodion, which can be bought ready made from dealers in photographic supplies, and next sensitized by dipping for a minute or two in nitrate of silver bath prepared as follows:

Nitrate of silver	437 grs.
Distilled water	16 oz.
Nitric acid	3 drops.

Saturate the solution with iodide of silver and then filter. If the bath is milky, set the bottle in the sun for two days, until the solution clears up. Then decant, and it will be ready for use. After sensitizing, the plate, while wet is at once exposed in the camera, then removed from the plate holder and immediately developed with the following solution:

Protosulphate of iron	1½ oz.
Nitrate of baryta	1 oz.
Water	16 oz.
Alcohol	1 oz.
Nitric acid	40 drops.

After dissolving, filter out the white deposit and keep well corked. When developed, it is washed under the tap and fixed in a solution either of:

Cyanide of potassium	30 grs.
Water	1 oz.

or

Hyposulphite of soda	50 grs.
Water	1 oz.

The cyanide of potassium is a deadly poison, and is only advantageous to employ when it is desired to tone the slide to a blue color soon after fixing. When hyposulphite of soda is used, the plate should be thoroughly washed under the tap for two or three minutes. After fixing, the slide may be toned to a brown color by a solution of chloride of gold 1 gr., dissolved in 10 oz. of water, or instead a purple color, by a solution of ¼ grain of bichloride of palladium to one ounce of water, in a clean porcelain dish or tray. The solution should be strawberry in color. The plate should be left in the tray until the film assumes a black color on both sides, when looked at by reflected light. The tones are more easily obtained when the slide is fixed with cyanide of potassium. Very good slow gelatino-bromide plates can be purchased, known as lantern or transparency plates. These may be exposed in the camera, or by contact with a negative. Then they are developed in solution of hydrochinon 15 grains, sulphite sodium 50 grs., water 1½ ozs., carbonate of potassium 30 grs., and fixed in a solution of hyposulphite of soda 1. oz. to 8 of water. Several plates, 4 or 6, may be developed at one time in this developer, and are then removed as fast as developed.

(6) St. M. I. asks (1) for a simple method of purifying and decolorizing crude bitartrate of potassium as obtained from wine casks. I have a certain quantity on hand and would like to decolorize it. Indicate any method, but the simplest is preferable. A. The tartar, previously pulverized, is boiled with water in copper boilers. The solution when saturated is transferred to earthen pans, where it deposits on cooling a crystalline layer, nearly free from color. This is redissolved in boiling water, and the solution, having been mixed with 4 or 5 per cent of pipe clay, is evaporated to a pellicle. The clay precipitates with the coloring matter, and the clear solution, as it cools, deposits white crystals in crusts, which, upon being exposed to the air on linen for several days, acquire an increased degree of whiteness. These constitute the crystals of tartar of pharmacy. 2. We find some difficulty in working the Toepler-Holtz frictional machine, and are unable to place the cause; for, a year ago, it worked after turning but a few times, and now it requires quite a length of time to charge it. If the plates are to be varnished, please indicate how to prepare the varnish. A. Wipe off with a warm dry cloth all parts of the machine. Dust as well as moisture interferes with its action. The varnish for the plates is alcoholic solution of shellac. 3. How many 1 gallon Bunsen cells are required to run two six-candle power lamps? A. About ten cells.

(7) W. J. M. asks: 1. What is the vulcanized fiber washer that clamps the glass disks to the bosses in a Wimshurst influence machine composed of, and how made? A. They are made of India rubber, sulphur, and other substances. You can buy it in large or small pieces of dealers in electrical supplies. 2. I have a Holtz machine, and the amalgam in using is mercury, tin, and zinc. I am told there is a better amalgam which is of an old gold color. Can you tell me how to make it? A. It is bisulphide of tin, the old aurum mussivum, formed by sublimation from an amalgam of tin 1 part, mercury 6 parts. Of this amalgam 18 parts are mixed with 6 parts salammoniac and 7 parts sulphur. The bisulphide of tin remains behind in the retort. No amalgam should be used on a Holtz machine. 3. Are dry cells which are made in Germany equal to the Leclanche cell? Can you inform me what they are composed of? A. Dry cells are of rather high resistance. Gelatin or agar-agar jelly is used in them instead of water. 4. What chemical is it you apply to a file so you can file glass? A. Turpentine and camphor, or simple water. —We can give no information as to the gas lighter you speakof.

(8) J. H. K. asks: 1. Will the motor described in SCIENTIFIC AMERICAN, March 17, run an ordinary tricycle and about what speed? A. It should develop a speed of about 8 miles an hour. The trouble would be to get a compact and light battery. 2. Is there any good paste to make paper adhere to a brick wall exposed to the weather? A. Shellac is the best we can recommend, and that is imperfect. Tack muslin over the wall and stick paper to that. 3. I have read with a great deal of interest the articles on speed of railroad trains, and would like to know the fastest time ever made, and where and when? A. On the New York, West Shore and Buffalo Railroad, between Churchville and Geneva Junction, on July 9, 1885, a special train attained a speed of 87 miles per hour. It ran 422·6 miles in 9 hours and 23 minutes.

(9) D. J. B.—You cannot keep the bright color of polished iron on the hot parts of an engine without constant attention and wiping with engine oil. Oxalic acid may help the cleaning, but the acid left on the bright surface favors oxidation. For cleaning, use tripoli, rotten stone, or pulverized pumice stone, with engine or kerosene oil. Neglected or dirty spots may be removed with a scraper and fine emery paper, and afterward rubbed with oil. Every part of bright work around an engine should be wiped with oil. Moisture immediately discolors a clean bright surface. Polish the lubricator with rotten stone and oil only, and only when necessary. Too much polishing soon makes it look old from wear.

(10) G. asks how to make the preparation whereby solder will readily affix itself to other metal than tin; for instance, brass wire, etc. A. Use a solution of chloride of zinc and chloride of ammonium, or what is called tinner's acid, which you can make by dissolving zinc in hydrochloric acid to saturation. Add 10 to 20 per cent water and as much sal-ammoniac as the bulk of zinc dissolved.

(11) C. F. R. asks a formula for giving a green color to finished steel. A. We know of none that will wear well. The sulphide of lead process gives a film of variegated colors, which may be covered with lacquer. The article must be perfectly clean, with a dead finish, then dip in a solution of 1½ ounces hyposulphite soda in 1 pint water, in porcelain dish, to which add 1½ ounces acetate of lead previously dissolved in 1 pint of water. Mix and heat the whole to nearly boiling, 200°. Boil the article in caustic soda and water strong enough to clear of grease or finger marks, rinse in boiling water. Dip in the hot solution and examine until the desired color is obtained, which may be seconds or minutes. The effect runs through several colors in succession.

(12) Yacht.—The determination of the draught lines of a yacht is not an easy matter for an amateur. The weight of all the materials composing the hull, rigging, ballast, and furniture of the yacht must be computed from the details of the design, and the displacement of an equal weight of water computed within the lines of the boat. For the details of construction we refer you to SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 42 and 67, also "Model Yachts and Model Yacht Sailing," by Walton, which we can mail for $1.25.

(13) P. H. G. asks (1) why steam exhausted into the atmosphere on a cold day lasts much longer than the same amount exhausted on a hot summer's day. A. In a hot, dry air the steam is instantly absorbed by the air and becomes transparent, warm, dry air having a large capacity for holding moisture. On the contrary, cold, moist air may be saturated with water and has little or no capacity for further absorption. Then the exhaust floats away in clouds. 2. What is the cause of that peculiar roar which often issues from elevated road locomotives? A. The roar you refer to is probably that caused by the vibration of the safety valve in blowing off. As it is held by a spring only, it at times vibrates or chatters when the steam pressure is just enough to barely lift the valve.

(14) V. M. C. writes: 1. Can you describe any process by which drawing paper can be made perfectly transparent temporarily, that is, to have it come back to its regular appearance and condition again after the process, when required? A. Treat with castor oil, and it will be transparent; afterward dissolve out the oil with alcohol. 2. Can you describe something to harden crayon pencil and charcoal drawings and sketches so that they will not fade soon or rub off; something easily applied and able to give satisfaction in general? A. Lay paper in a shallow dish, and pour skimmed milk over it. When well wet all over, raise into a vertical position and allow it to drain, removing with a feather the last drops from bottom edge. Dry carefully. Or wash it over with warm starch solution, thin isinglass water, or rice water, applying it with a broad camel's hair brush.

(15) J. D. B. and E. R. C. ask: 1. The ingredients, and their proportion, for the best cement to attach bicycle tires to their wheels? A. You can make a very strong and tough cement by dissolving 1 part pure India rubber in 12 parts benzine, then adding 20 parts shellac, and heat carefully away from fire until the shellac is dissolved and the benzine has evaporated. 2. Is there any work published treating of the manufacture of bicycles? A. No, except as you will see the different styles described in trade catalogues. 3. Is there a work on japanning or enameling, giving description of best arrangement of drying ovens, etc.? A. You will find an article on japans and japanning in SCIENTIFIC AMERICAN SUPPLEMENT, No. 316. Also see "Workshop Receipts," third series, which we mail for $2.

(16) B. M. P.—Tell your friend the finest stationary engines made in the world, for economy, durability, and elegance in design, are made in the United States of America. English engines are often bulky and clumsy. French engines are frequently erratic in design and fragile in construction.

(17) D. M. M. asks if there is any way to extract the oil from lamb's wool in alcohol. What proportion of alcohol to wool should be used? Will the result be solid like lard or look more like the alcohol? I have tried the experiment of boiling both together, but it does not seem to change either. Perhaps you will tell me why. A. For extraction of oil we should advise the use of ether and a continuous fat extractor. On exposing the ethereal solution to the open air, the ether will spontaneously evaporate, leaving the oil. We doubt if you extracted much with alcohol, as the latter is readily diluted by any water in the wool. Such an extractor as we refer to is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 628. The oil will probably be yellow and thick as butter.

(18) D. T. S. asks: 1. Whether or not there is any way of preserving (permanently) the beautiful polish of which copper is susceptible. A. Varnishing with shellac while the metal is warm and absolutely free from the least particle of grease is a good method. 2. Can you give recipes for making gold and silver inks? A. Gold or silver leaf are rubbed up with honey and diluted with water.

(19) A. G. B. asks how to make cake stencil ink, and used by wetting brush with water. A. Mix and dissolve hot, 1 part gelatine in 1 part water, and add and stir in sufficient coloring matter; 3 parts lampblack and a little indigo is a good mixture. To above 1 to 2 parts of glycerine may be added to make it softer.

(20) C. I. M. asks for a receipt for a stove blacking. A. 2 parts copperas, 1 part boneblack, 1 part black lead, mixed to consistency of cream with water. Two applications are recommended.

(21) C. A. B. writes: I should like to know the most simple method of accurately determining the amount of tannin in the various tan liquors used in tanning leathers? A. The determination of tannin is sometimes attempted by the use of the hydrometer. The only correct methods require considerable skill in chemical analysis. Sometimes pieces of raw hide are weighed dry, soaked in the solution, dried, and weighed, and the increase in weight is called tannin. This is not a very accurate method.

(22) S. C.—The outside of finished bells are turned at a slow speed with very hard tools or scrapers. Dipping the castings in water before they are cold (300° to 400° temperature) will throw off the sand. If the metal has been poured very hot and the sand burnt in, an acid bath may be used, of nitric acid 1 part, water 4 parts.

(23) P. P. D.—Steam and the water in the boiler at 95 pounds pressure both have a temperature of 320° Fah. At 125 pounds pressure the temperature of both will be 352° Fah. Water can be heated to any temperature by confining it.

(24) W. H. G.—If you cannot wash off the fly specks with soap and warm water on a cloth, there is no way that an amateur can refinish lamp work with any satisfaction. To do this, the lamp must be taken apart and the brass work boiled in caustic soda to remove all oil and varnish; then rinse in hot water and dip in strong nitric acid for a few seconds only, when it will come out clean and bright, then rinse clean in boiling water. Dry in sawdust, brush off, and lacquer with thin shellac varnish. The metal must be warm and perfectly free from grease.

(25) K. K. W.—The rust on the inside of your shot gun can be removed by rubbing with a perforated cork glued on a stick of wood. The cork is to be trimmed with a sharp knife to fit tightly in the barrel. Then with oil and ground pumice stone, or tripoli, polish the inside of the barrel until it is free from rust.

(26) H. S.—A little pulverized sal-ammoniac sprinkled on tin will make it flow free and clear. There is nothing but an alloy of other metal that will make it melt at less than its normal temperature.

(27) S. C.—The best covering for pulleys is leather. Roughen the pulley with an old file. Use the best glue, with its dry weight of glycerine made in the ordinary way. Glue the leather to the iron pulley and lap from two to three inches. Tough paste board does well while it lasts. Leather is the cheapest by its durability.

(28) H. C. J. asks whether it requires greater velocity for a rifleball to go through two 1 inch boards nailed together or through one 2 inch board. A. The penetration of shot is favored by a division or lamination of the resisting medium. The two 1 inch boards together require the least velocity for perforation.

(29) G. B. C. asks: Can you tell me of any filter or material for one that will filter lime water and remove every trace of lime from it, leaving it pure? A. Lime cannot always be removed from water by filtration. Sometimes it has to be boiled to secure precipitation, sometimes it cannot be practically removed by any means. It all depends on the form in which it is present. If once precipitated, any good filter will remove it.

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(30) T. D. B. asks: 1. How to stain a sole leather bag somewhat abraded a dark mahogany color. A. Mix 15 grains alkanet root, 30 grains aloes, 30 grains dragon's blood, all in powder, with 500 grains alcohol (95 per cent). Moisten the bag with dilute nitric acid (1 acid to 5 water by volume) and then apply above solution. Repeat until dark enough. 2. I wish to calculate the power of a flow of water which flows in a broad, thin stream over a dam. A. Determine the "head" measured from level of main body of water above the dam to the level of the top of the dam, then multiply length of dam by 3·33, and multiply this by the square root of the cube of the head expressed in feet and decimals. The result will be in cubic feet. See Trautwine's "Engineer's Pocket Book," page 265. 3. What is the resistance approximately of carbon in sectional area such as is used in arc lamps and how to calculate the resistance at different temperatures? A. Carre's circular carbons 1 millimeter (0·04 inch) diameter have 50 ohms resistance per meter (39·37 inches). The resistance diminishes as the temperature increases. Between 0° and 100° C. the coefficient of reduction is 1-1912. This you can easily reduce to Fahrenheit's scale.

(31) T. A. R.—There is no way to bend wood better or cheaper than by steaming. Gun stocks, if bent at all, are steamed and bent in the rough. The trimmings are put on after the stock is finished.

(32) M. F. S. asks how to solve the following questions: No. 1. A clerk spends 20 per cent of 66⅔ per cent more than ½ of his salary, and thereby saves $533. What is his salary? No. 2. A cabinet maker directed his salesman to mark a set of furniture so that, by allowing 20 per cent on the marked price, he would realize a gain of 25 per cent. The salesman marked the set by mistake $200, or at a loss to the dealer of 20 per cent of the sale. At how much less than the required marking price were the goods marked by mistake? A. Solve No. 1 by following equation: Let x = salary; then:

$$x-(\tfrac{2}{3}\times\tfrac{1}{5}+\tfrac{1}{2})\,x=533$$
$$x=\$1{,}453.63.$$

Solve No. 2 by following equations:

Let x = proper marking price, then y = cost.

$$(1)\quad y=x-\tfrac{1}{5}x-\frac{x-\frac{1}{5}x.}{5}$$

$$(2)\quad y=200-\tfrac{2}{5}\tfrac{0}{0}-\frac{200-\frac{2}{5}\tfrac{0}{0}}{5}=192$$

$$x=300.$$

Or by analysis they may thus be solved: 1. He spends ½ of his salary plus $\frac{66\frac{2}{3}}{5}$ of his salary, and what is left amounts to $533. Taking it by percentages, what he spends reduces to 50 per cent + 13·33+ per cent = 63·33+ per cent. Subtracting this from 100 gives 36·66+ per cent of his salary left unspent, which is equal to $533. His full salary, therefore, is equal to $\frac{533}{36{\cdot}66\times100}$ or 1,453.90 within limits of errors due to continued fractions. This is one solution, but the problem is worded so badly that several meanings may be drawn from it. 2. The suit marked at $200 was sold at $200 less 20 per cent, or $160. This gave a loss of $160 × 20 per cent or $32. Thus the goods cost $192. They were to be marked so that the selling price should give a profit of 25 per cent; $192 × 25 per cent gives $48. The selling price should have been, therefore, $240. To this 25 per cent must be added for the marking price, or 240 × 25 per cent, giving $60. The marking price should have been $300.

(33) Benzine asks: 1. How can I color a solution of rubber in benzine, black and brown? A. Use asphalt or coal tar. 2. Does dragon's blood dissolve in benzine? A. Yes. 3. Would be glad to know through your valuable paper of a few colors that dissolve in benzine. A. Alkanet root extracts are peculiarly available for coloring benzine.

(34) L. M. R. writes: I have an incomplete Bunsen 6 by 8 inch battery, a zinc plate 2½ in. wide being substituted for the zinc cylinder. Will you please inform me how much and what kind of acid I must use to complete the battery? A. For porous cup use following solution: Mix ½ part by weight of sulphuric acid with 3 parts water carefully and allow to cool. Dissolve six parts by weight bichromate of potash in 16 parts by weight of water by boiling, when cool mix two solutions and stir well. Use when cold. For glass jar use water.

(35) C. H. asks: How to transfer a printed illustration on paper to a glass magic lantern slide. A. Soak the print in soft water, varnish or float the glass plate with dammar varnish or Canada balsam. Allow to nearly dry; when still tacky carefully press the wet print upon it, and let all dry. Then with a wet finger you can rub off the paper, leaving the ink. A second coat of varnish will improve it.

(36) W. McP. asks: 1. Before a rain, the atmosphere contains moisture. The atmosphere and moisture weigh more than the atmosphere alone. Why then does the barometer not rise instead of falling? A. A falling barometer indicates the center of a storm disturbance, a rising one indicates its margin. These changes correspond with the rotary movements of the air, and not to the presence or absence of watery vapor in the air. 2. Can an electro-magnet be constructed in the form of a ring? If so, what parts correspond to the poles? A. It can be magnetized so that one end of a given diameter will be north and the other end south, or it may be magnetized so that it will exhibit no polarity until broken, when the ends will become magnetic poles. 3. Are street cars propelled by electricity a success? If so, why are they not more generally used? If not, where does the trouble lie? A. Yes; they are being rapidly introduced all over the country. 4. How fine a wire must be used in the secondary coil of an induction coil? A. No. 36. For induction coil construction we refer you to our SUPPLEMENT, No. 160, which we can send you for ten cents.

(37) J. C. K. asks the most economical and most effective point at which to set compound engines, where there is a coupling between them, to get best results. A. Set the cranks at right angles

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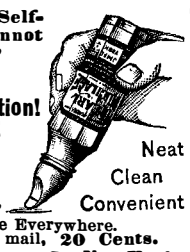

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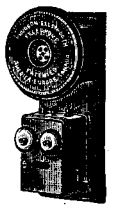

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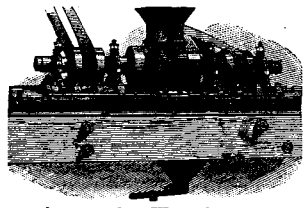

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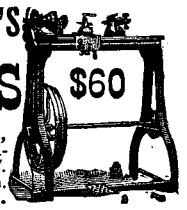

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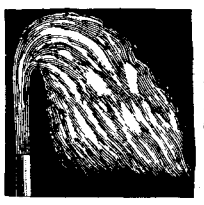

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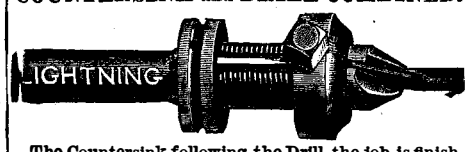

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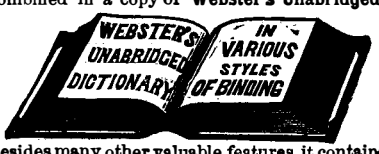

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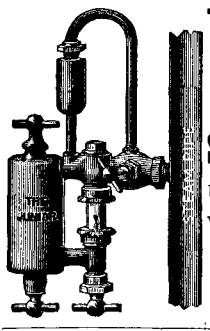

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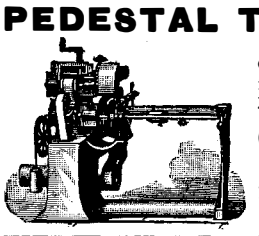

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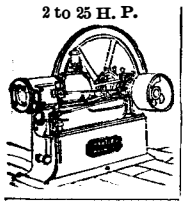

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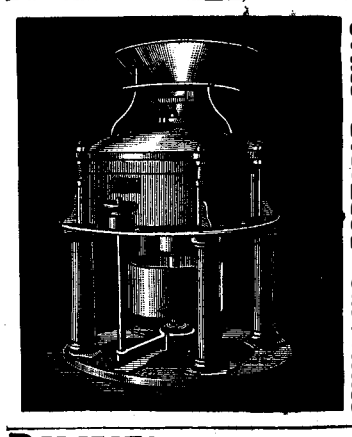

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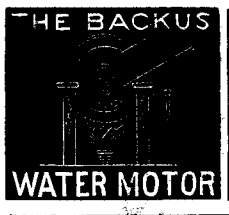

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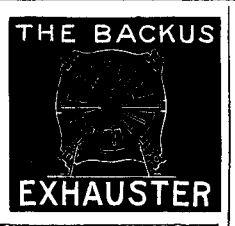

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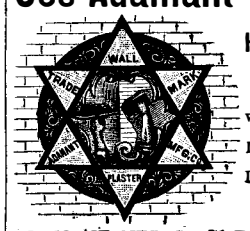

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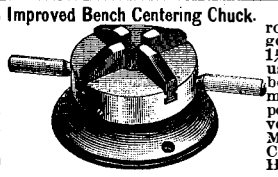

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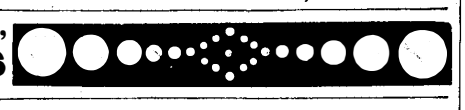

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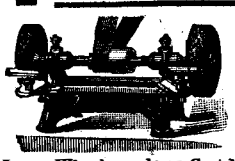

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Dredging at Wilson's Point, Norwalk Harbor, Conn.—ENGINEER OFFICE, U. S. ARMY, Room 57, Army Building, cor. Houston and Greene Streets, New York, *November* 13, 1888.—Sealed proposals in triplicate for dredging at Wilson's Point, Norwalk Harbor, Conn., will be received at this office until twelve (12) o'clock M. on Thursday, December 13, 1888. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. Further information, specifications, and forms of proposals can be obtained at this office.
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Breakwater at New Haven, Conn.—ENGINEER OFFICE, U. S. ARMY, Room 57, Army Building, cor. Houston and Greene Streets, New York, *November* 13, 1888.—Sealed proposals in triplicate for breakwater at New Haven, Conn., will be received at this office until twelve (12) o'clock M. on Thursday, December 13, 1888. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. Further information, specifications, and forms of proposals can be obtained at this office.
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Dredging in Five Mile River Harbor, Conn.—ENGINEER OFFICE, U. S. ARMY, Room 57, Army Building, cor. Houston and Greene Streets, New York, *November* 13, 1888.—Sealed proposals in triplicate for Dredging in Five Mile River Harbor, Conn., will be received at this office until twelve (12) o'clock, M., on Thursday, December 13, 1888. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. Further information, specifications, and forms of proposals can be obtained at this office.
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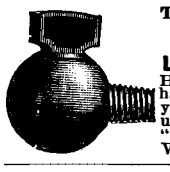

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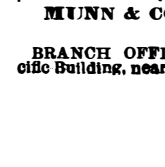

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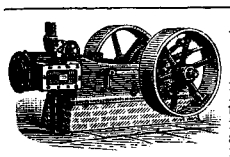

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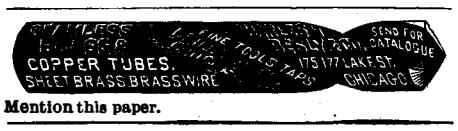

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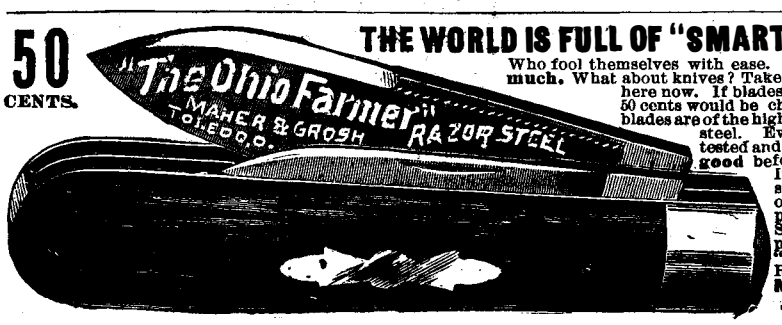

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